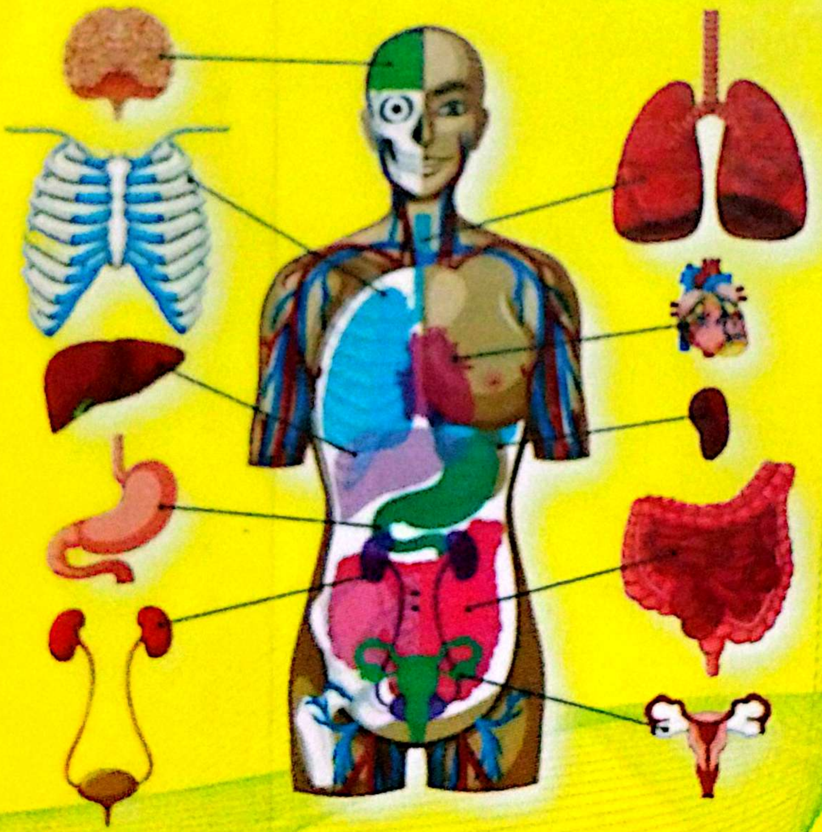
Extreme
Series

BIOLOGY

GRADE 9 - 10



Extreme
Series

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UNIT 1

Introduction to Biology

1.1 What is Biology?

The word biology is derived from two Greek words: Bios and logos.

Bios - Meaning “life” and
logos - Meaning “study”

- Biology is a branch of natural science which studies about living things.
- Biology is the science of life and living organisms.

Biological science is a multidisciplinary study which has various sub branches of study. Among these, some of them include:

Zoology: is the branch of biology which studies about animals.
Botany: is the branch of biology which studies about plants.
Genetics: is the study of heredity and variation.
Entomology: is the study of insects.
Ornitology: is the study of birds.
Ethology: is the study of animal behaviours.
Mycology: is the study of fungus.
Anatomy: is the study of internal structure of an organism’s body.

Ecology: is the study of the interaction between organisms & their environment

Physiology: is the study of functioning of internal structure of living things.

Palaeontology: is the study of fossils.

Taxonomy: is the study of classification and naming of organisms.

Cardiology: is the study of heart.

Microbiology: is the study of micro organisms.

Parasitology: is the study of parasites.

Cytology: is the study of structure & functions of cells.

What does it mean to be "alive"

Life is mainly recognized by characterstics shared in common by living systems.

Living things Shared in Common. They

- Are composed of one (unicellular) or more cells (multicellular).
- Are complex and highly ordered.
- Can respond to stimuli, can grow, reproduce, nutrition, respiration, etc.
- Transmit genetic information to their offspring.
- Need the energy to accomplish work.
- Homeostasis (maintaining constant enternal affairs)
- Are capable of adapting to the environment, etc.

What relation ships does biology have with other fields of natural science?

Explanation

The study of biology is a point of merging information and tools from all natural sciences:

Example:

1. **Biology and Chemistry:** The information about naturally occuring elements in living organisms, chemical bonding, acids, bases, etc can be studied using chemistry.
2. **Biology and physics:** conversion of radiant energy (sun light) in to organic molecules (food). by photosynthesis chemistry and physics. Absorption of water by roots from the soil and transportation can be studied using physics.

3. **Biology and chemistry:**
   - Photosynthetic reaction is studied with the knowledge of chemistry.
   - Respiration reaction to release energy is studied by chemistry.
4. **Biology and maths:** How many diversified species of organisms present in the ecosystem.

1.2 Why Do We Study Biology?

Explain why biology is studied?

Explanation

Studying biology help to understand:

- How living things work
- How they function and interact with the environment.

Biology touches our every day life in many ways.

Example

- Biologists have discovered drugs to treates many diseases.
- Many biologists are working on problems that affect our lives.

Such as How plants and animals body works,

- How ecosystem works.
- How genetics and cell biology are transforming to medicine and agriculture.
- How forensic biology (using genetic finger printing) to investigate crime.
- How ecology is helping society to evaluate the environmental issues such as global warming
- How fermentation is used in the production of alcoholic drinks and varieties of foods.
- In addition biological studies are used in treating patients suffering from AIDS. TB (tuberculosis), malaria, cancer (some) etc.
- To device effective methods of contraception.

Application of Biology in out day to day life

Give examples of Biological application?

Explanation

i. **Fermentation:** Used to produce alcoholic drinks such as wine, beer, tella, katicala
   - Baking of bread and injera.
   - Production of milk and products such as cheese, yoghurt, etc.
   - The process of producting alcoholic drinks such as wine, tella, etc and Baking bread and injera using yeast cell is called alcoholic fermentation.
   - The process of milk and milk - products such as cheese, yoghurt is called lactic fermentation. Lactic fermentation is by using bacteria
   - Yeast cells used in alcoholic fermentation and bacteria used in lactic fermentation by using their enzymes.

ii. **Antibiotics:** Such as pencillin produced from fungi called *pencillium notatum* or from bacteria in medicine.

iii. **Production** of industrial chemicals such as citric acid, acetic acid or lactic acids needs bacteria or fungi to bring about chemical changes.

iv. Forensic analysis of DNA (genetic finger printing) sample from crime scene to investigate crime.

v. Production of selected seeds and stocks - for agriculture.

vi. Production of insulin, vaccines and enzymes in medicine

vii. To device effective methods of contraception.

1.3 The Scientific Method

What is scientific Method?

Explanation

- Scientific method is the process by which scientists approach their works.
- It is a method that is used by scientists to solve problems in the society.
- Biologist study about living things using a scientific method. For centuries, people based their explanations of what they saw going on around them on observations then to conclusion. Why or how things happen? by asking questions and seeking science - based responses is know as scientific method.

The Main Steps of Scientific Method

The Main Steps of the scientific Method is:

1. Observation
2. Asking question (Identifying the problem)
3. Do back ground research
4. Formulating a hypothesis
5. Experimentation (Testing the hypothesis)
6. Drawing conclusion.
7. Reporting the results.

1. **Observation:-** The scientific study begins which careful observation that leads to asking the questions.
   - The problems can be identified through direct and indirect ways.
   - Directly through observation by sense organs, life experience & exposure.
   - Indirectly through readying, learning, internet, scientific tools such as microscopes.

2. **Asking question**
   - The observations usually leads the scientist to ask questions.

3. **Back ground research:**
   - Before investigation, we will first check scientific magazines, internet, books etc.
   - To see if any one else has looked in to asimilar problem.

4. **Formulating a hypothesis**
   - Hypothesis is a tentative idea that explain the observed facts and predicts the new out comes.

- ➥ Hypothesis is testable by an experiments

5. Experimentation

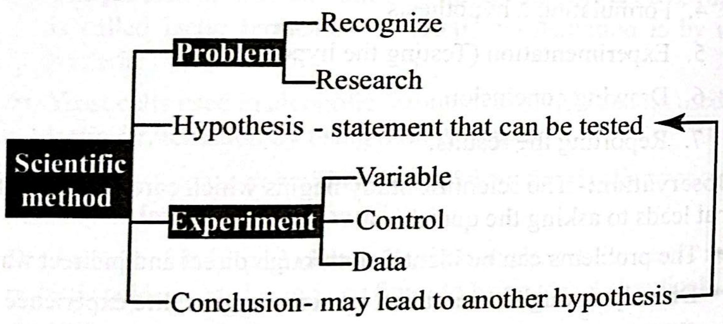
- ➥ Hypothesis can be tested through experimentation
- ➥ Repeat the experiments and confirm the tests which is necessary to determine whether results will be consistent as predicted.

6. Draw conclusion and report the result

- ➥ Making conclusions about the findings.
- ➥ If the hypothesis is accepted, it is published in scientific publications which are called scientific journals.

7. Theory: A theory is a hypothesis that has been tested again and again by many scientists, with similar results each time.

Idea Map **Scientific Method**


Recognize
Problem
Research
Hypothesis - statement that can be tested
Scientific method
Variable
Experiment
Control
Data
Conclusion- may lead to another hypothesis

Science

What is Science?

Science is a systematic body of knowledge developed as a result of observations and practical experience of human beings in their attempt to understand and control nature.

In science knowledge is acquired on the basis of scientific method.

Scientific methods are important:

- ➥ To solve problems
- ➥ To discover facts and principles
- ➥ To formulate laws and theories.

Science is also referred to as experimental study because it involves the use of experiments in obtaining and proving informations.

Conceptual Examples

Explain the following Questions

1. Write the correct step of scientific method.

Explanation: 1. Observation
2. Asking questions (Identifying the problem)
3. Doing back ground research
4. Stating a hypothesis
5. Experimentation
6. Data analysis
7. Draw conclusion
8. Reporting the result
9. Theory.

2. What is a tentative explanation of a certain scientific investigation?

Explanation

Hypothesis is a tentative explanation of the observed facts.

3. How a scientists intertain the hypothesis in order to advance his investigation to the level of a theory?

Explanation

The hypothesis should be repeatedly confirmed by the experiments

4. Give at least five examples of the application of biology in our daily life?

Explanation

1. In medicine: the production of antiblotics called pencillin
   - ➥ Vaccines and insulin
2. Alcoholic fermentation production of alcoholic drinks & food.
   - ➥ Lactic of fermentation (production of milk produces)
3. Production of industrial chemicals like citric acid, lactic acid, aceticacid
4. Crime scene investigation using forensic analysis of DNA.
5. In agriculture production of selected seeds and stocks.

Illustrative Example

I. Choose the best answer from the given alternatives.

1. In scientific methods, a hypothesis that is formulated should be:

A) Never been disproved
B) Tested through experimentation
C) Proved to be a theory
D) Accepted and proved to be alow.

Answer: B

2. What is entomology? It is:

A) The biology of insects
B) The biology of fish
C) The biology of birds
D) The biology of fungi

Answer: A

3. A biologist in the field who studies a behaviour of arbo reals in the forest is most likely expected frequently use which method of data collection?

A) Experimentation
B) Observation
C) Analysis
D) Hypothesis

Answer: B

4. Which of the following is **not** a property of life?

A) Population of organisms rarely changed over time
B) Living things exhibit complex bur ordered organization
C) Organisms take in energy and use it to perform all of life activities.
D) Organisms reproduce their own kind

Answer: A

5. Hypothesis in biology is best described as:

A) Possible explanation of an observation
B) An observation that supports a theory
C) A general principle that explain some aspect of life
D) An unchanging statement that correctly predicts some aspect of life .

Answer: A

Explanation

A hypothesis is a tentative explanation or idea about an observed problems.

6. Which of the following corresponds to the beginning steps of a scientific work?

A) Testing hypothesis
B) Making observation
C) Conducting experiments
D) Drawing conclusion

Explanation

Making initial observations is the first step of scientific method.

7. The process that scientists use in their investigation

A) Scientific method
B) Observation
C) Prediction
D) Research

Answer: A

8. The production of alcoholic drinks and antibiotics is:-

A) Theoretical biology
B) Application of biology
C) Research biology
D) Process of biology

Explanation

Biology is applied in our daily life in the production of food such as injera, bread and in the production of antibiotics and different alcoholic beverages.

Answer: B

9. How biology is applicable in controlling and treating diseases such as malaria and tuberculosis by Identifying:

A) Controlling the dreading areas of mosquito
B) Transmission ways of the disease
C) Prevention methods of the diseases
D) All of the above

Answer: D

10. The science that studies about the interaction between organisms among themselves and with their non - living environment is:-

A) Ecology B) Botany C) Ecosystem D) Zoology

Answer: A

11. A hypothesis that is formulated should be:

A) Never been disproved
B) Tested through experimentation
C) Proved to be a theory necessary
D) None.

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Explanation

Ahypothesis can be proved or disproved

- Can be tested through experimentation
- It it is proved & accepted can be added as a body of knowledge.

Answer: B

1.4 The Tools of a Biologist

What are the tools of a biologists?

Tools are apparatus that biologists use in the laboratory and field for scientific investigations. There are different types of tools of biologists. Some of the tools are used far measuring, some are used for observation and some are used for culturing micro organisms.

1.4.1 Laboratory Tools of Biologist

What are the major tools of biologists in the laboratory?

1. Tools For Measuring Volume

- Measuring volumes are used to measure the volume of a liquid and volume of a gas.
- These are: - Measuring cylinder

➥ Pipette ➥ Syring ➥ Burette

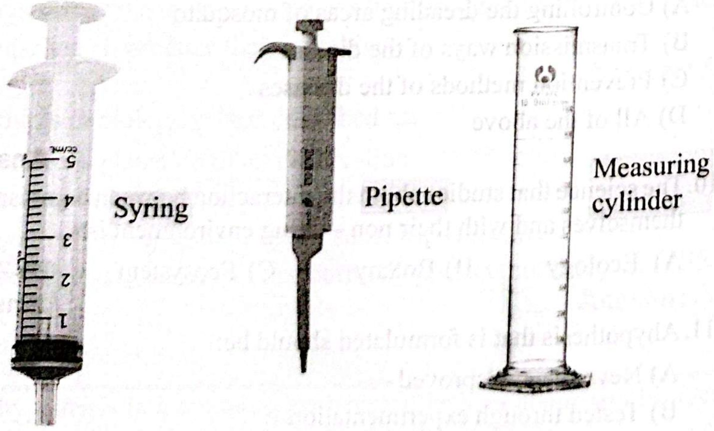


Fig 1.1 **Tools for Measuuring Volume**

2. Hand Lens

Most cells can not be seen with the naked eye a hand lens has a higher magnification than our naked eye. It is convex lens.

The main function of a hand lens is to provide an enlarged image of the object placed under it. But not sufficient to observe the detail in cells.

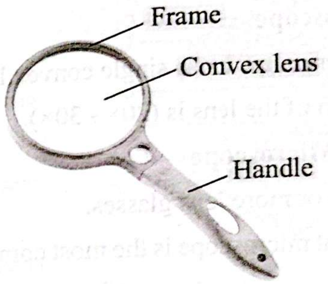


Fig 1.2 **Hand lens**

3. The Microscope

One of the most important tools of the biologist is a microscope. A microscope is an instrument used to study objects that are too small to be seen with anaked eye. The important function of microscope is magnification and resolution.

Magnification: is the ability of a microscope to enlarge the image size of the object observed (looks bigger) than its actual size.

Resolution: is the ability of a microscope to distinguish between two separate points.

- It shows the detailed scattered parts of an object seen.
- The capacity of the microscope to resolving an object is called resolving power.
- The greater the resolving power of a microscope the clearer the image of the object seen is.

There are two Types of Microscope

According to the type of light they use for observation

- Light microscope
- Electron microscope

I. The light microscope

- Use beam of light to view specimens based on the number of lens it categorized in to two:
  - i. Simple light microscope
  - ii. Compound light microscope

i. Simple light Microscope

- Simple light microscope has a single convex lens.
- It's magnification of the lens is (20× - 30×).

ii. Compound Light Microscope

- Consistes of two or more lens glasses.
- A compound light microscope is the most common microscope us in biology.
- It consistes of two lens systems (combination of lenses) to magni the image of an object up to 2000×.
- Each lens has a different magnifying power.

A compound microscope can be:

- **Monocular:** a compound microscope with a single eye piece lens
- **Binocular:** a compound microscope with two eye piece lenses.

The image of the specimen is focused by two types of lenses, kno as eye - piece lens and objective lens. The compound light microsco magnification is the product of eye piece lens and objective lens, × 10 e piece lens and 40 objective lens, the total magnification is × 400.

parts

1 Eyepiece
2 Objective lenses
3 Stage holder clamp
4 Mechanical stage
5 Condenser
6 Adjustment knob
7 Illuminator
8 Base
9 Diopter
10 Binocular head
11 Head locking screw
12 Nosepiece
13 Arm
14 Coaxial focus knob
15 Iris diaphragm
16 Limit stop lock
17 Stage control knobs
18 Illuminator adjustment wheel
19 Power switch

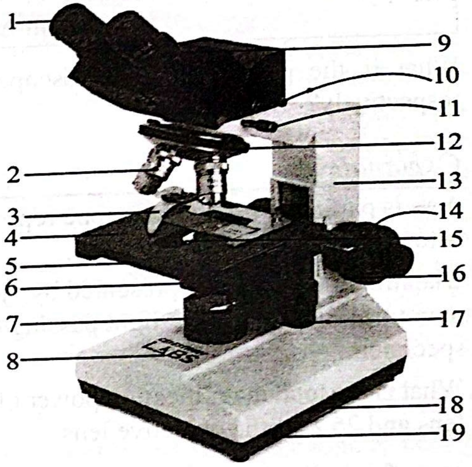


Fig 1.3 Compound Microscope

Conceptual Example

12. Compare and contrast the light microscope with that of electron microscope?

Explanation

- Light microscope use beam of light to view small objects, but the electron microscope uses the beam of electron. The electron microscope has high magnification and resolution power than the light microscope.

13. The following table sows parts of light microscope and their function.

Parts of Microscope	Functions of Parts
Eye piece lens	Magnify the image
Stage clips	Hold the slide in place
x	Carry the microscope
Base	Used for support

y	Adjust or control the amount of light passing through the stage.

What is the parts of the microscope represented by "*x*" and "*y*" respectively?

Explanation

Arm is parts of a light microscope represented by "*x*" whose function is to carry the microscope.

Diaphragm (or iris) is represented by "*y*" whose function is to adjust or control the amounts of light passing through the stage or the specimen.

14. What is the total magnification power of a microscope with 10× occula lens and 25 × of the objective lens

Explanation

Eye piece lens × objective lens = Magnification power.

10 × 25 × = 250×

II. Electron Microscope

What is electron microscope?

Electron microscope that use abeam of electrons and electron magnets (instead of glass lens) to enlarge the image of an object.

- These microscope provide a higher magnification and resolution power than light microscope and used to observe extremely small micro organisms such as viruses.

4. Autoclave

- The equipment used to sterilize (or free from) micro organisms.
- Autoclave is a devise that used a steam pressure
- The boiling point of the steam is up to 120⁰C.
- Autoclave sterilize contaminated materials including culture media and bacteria spores.
- It is also used to sterilize surgical equipments.
- **Sterilization:-** is a complete removal of micro organisms by boiling it at high temperature and highly pressurized steam (steam pressure) (at 120⁰c) in autoclave for 15 minutes is called **sterilization.**

There are Many ways of killing micro organisms.

These are:

- ➥ Chemical disinfectants and anticeptics
- ➥ Ultraviolet light
- ➥ Flame (direct flame)
- ➥ Ionizing radiation (such as gamarays & beta rays)
- ➥ Dry or wet heat.

But some spore forming bacteria (endospore), which are resistant to chemical disinfectants, in these situation it is very important to use autoclave which kill micro organisms as well as their spores called sterilization.

5. Petri dish

- It is a glass or plastic dish used for growing or culturing cells or micro organisms in a suitable medium such as agar.
- Petri dish filled with solid nutrient medium called agar. Agar extracted from redalgae.
- Nutrient medium is a collection of nutrients (or other) for culturing (to grow) bacteria (micro organisms.)

Petri dish are Used to:

- ➥ Show the effective ness of antibiotics against bacteria.
- ➥ Show how well different concentration of enzymes digest a substance.

The nutrient medium in the Petri dish available as solid gel or liquid broth culturing medium.

6. **Centrifuge:** is a machine that spin at high speed to separate solid particles from a liquid.

Ultra centrifuge - is used to spin the tubes at faster speed to separate extremely light particles in to the bottom of the tube. Thus, it is used to separate plants and animals cells.

7. **Balance:** is useful for weighing the specimen, the solution or the product soon accurately.

8. **Flask:** an apparatus having a flat bottom and along narrow neck which allows easy mixing of the solution with out spilling out the content.

- ➥ It also used gently heat the content in side.
- ➥ Used to produce large population of micro organisms.

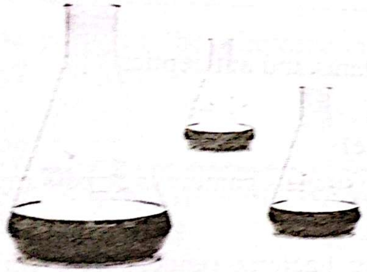


Fig 1.4 Flasks

9. Dissecting Tool Kit

Dissecting tool kit is used to dissect animals such as frog, mice, pig, rabbits, etc. to see their internal organs such as liver, heart, kidney, etc.

- It consistes of all the necessary tools required to carry out the process of dissection.
- Dissecting kit contain scalpels, forceps, mounted needles & magnifying glass.

Fig 1.5 Dissecting Kits

10. **Beaker:** Beaker is a cylinderical glass container used for making up solutions, holding hot or cold water, and soon.

Fig 1.6 Beaker

1.4.2 Field Tools

What do biologists use in the field ?

- **Biologist collect specimens from the field .**
- **Biologist identify and analyse the collected specimens.**

1. **Quadrat:- is a small frame made of wood or metal squar used to gain an estimate of the abundance of an organisms in an area.**
   A) It is placed on an area randomly and the organisms inside are counted.
   B) The number and types in the quadrat are recorded.
   C) Finally, the abundance of organisms is estimated based on the recordings from the sample quadrats.

Quadrats can be confined to land as well as water habitat.

If your quadrat measures $1m \times 1m = 1m^2$ suppose you place the quadrat 20 times, and find that species "A" occurs on an area on average, 3.5 times per quadrat.

- ➥ Estimate how many individuals are there in area "A" you are investigating.
- ➥ Suppose the area of this location is $500m^2$.
- ➥ Your records says there are 3.5 per m^2.
- ➥ So the total number must be $500m^2 \times 3.5 perm^2 = 1750$ organisms in the location you are investigating.
- ➥ Placing the quadrat randemly means you are not choosing where you will place them. So there is no bias.

Collecting Animals from the Field

- Collecting animals is relatively difficult because of their locomotory (Movement) nature.
- Some of the equipments that are used in the field for collecting animals include:

i. **Insect nets (Sweep nets):-** It is in sect collection net It is a bag made of cloth or fine mesh that attached to a wire loop used to collect insects from long grasses

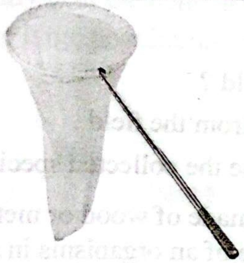


Fig 1.7 Sweep Net

ii. Pitfall trap: It is a container that is sunk in to the ground used to collect small crow ling insects (or animals) on the ground.

iii. Fishing net:- is a net used for fishing.

Some other equipments used by biologists on the field include:

- **PH kit** - to measure the PH.
- **Date logger** - for recording information
- **Flow meter** - to measure the rate of flow of water
- **Theodolite** - to measure the height of a trees or slopes in the area.
- **GPS (Global positioning system receiver):** is used for recording positions of a place quickly and accurately.

Conceptual Examples

Give short answer for the following questions

15. Mention the activities that are required by biologists in the field study?

Explanation

In the field study biologists are required to perform the following activities:

A) Take measurements in relation to abundance or distribution of organisms.

B) Take samples from the environments to be analysed in the laboratories.

C) To collect specimens.

D) To identify and analyse the collected specimen.

16. Write the function of the following common laboratory tools.

Explanation Table1.2

Type of tools	Function
Dissecting kits	Used to dissect and see the internal organs of animals
Centrifuge	Used to separate fine solid particles from liquids.
Petri dish	Used to culturing (growing) micro organisms or bacteria (culturing bacteria)
Balance	Used for weighting the specimen or the products of the reaction.
Flask	Used for mixing a solution with out spilling out the content.

17. What makes collecting animal specimens difficult when compared with plants?

Explanation

Since animals are capable of moving from one place to another while plants specimens are easy to collect.

18. List and describe the used of some equipments that are used by biologist in the field?

Explanation Table 1.3

Field Equipments	Function (uses)
Theodolite	to measure the height of a tree or a slope of an area.
GPS	Used to record positions of a place accurately
Flow meter	To measure the rate of flow of water
Quadrat	Used to gain an estimate of the abundance of organisms in an area.
Sweep net	Used to collect insects from long grass
Pit fall trap	Used to collect small crawling insets & animals on the ground.

Illustrative Example

19. The thod of a complete removal of micro organisms such as bacteria from equipments is called ______

A) Sterilization
B) Pasteurization
C) Disinfectant
D) Anticeptic

Explanation

Using autoclave equipment by using steam pressure which boil at a temperature of 120^{0}c for 15 minutes is called sterilization which can kills even the spore forming bacteria.

Sterilization is a complete removal of microorganisms, even the spore forming bacteria.

Answer: A

20. Which of the following biologist tool is more suitable for culturing (growing) bacteria in the laboratory?

A) Test tube
B) Petri dish
C) Beaker
D) Microscope

Answer: B

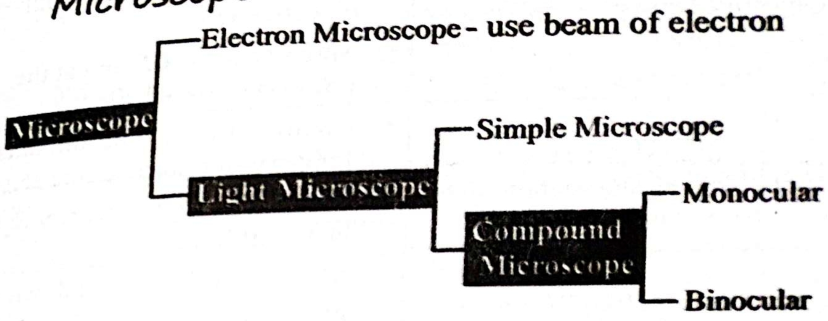
Explanation

The Petri dish used to grow (culture) bacteria in a controlled condition in a nutrient medium.

1.5 Handling and Using a Light Microscope

- Microscope is a vital instruments for biologists.
- Microscope has different power full lenses attached to it
- Microscope is in expensive tool of biologists. There fore, it is important to know the function of all structure of microscope and handle the device properly.

1.5.1 The Parts and Functions of the Light Microscope



The two types of Microscope are:

1. Light Microscope
2. Electron microscope

1. Light Microscope

- Use beam of light to view specimens.
- Based on the number of lenses, it categorised in to two:-

i. **Simple light microscope:** has a single convexlens.
   - The objects magnified 3× to 5× larger than it is.

ii. **Compound light microscope:**
   - Consistes of two or more lens glasses.
   - Compound light microscope is the most common microscope used in biology.

Table 1.1 The Component Parts and Function of the Compound Light Microscope

Parts of the Light Microscope	Functions of the Parts
Eye piece lens (occular)	• A convex tens used to magnify the image • Found at the top of the microscope • It's magnification is 10×

Objective lenses	• Further magnify the specimen at different intensify, with multiple objective lens. • Magnify the specimen at the power of 40× - 100×
Diaphragm (Iris)	• Control or adjust the amounts of light passing through the stage • Control the light intensity & the beam of light
Fine adjustment knob	• Move the tube up and down minimally (small amount) and produce sharp focus of the image • If regulates the distance between object & objective
Coarse adjustment knob	• Move the tube to adjust the difference between the object are objective lenses. • It's function is to capture the exact distance roughly and quickly.
Stage	• Support the glass slide and contains the specimen being observed. • The specimen is placed for viewing
Microscope Illumination (Light sources)	• It is the microscope light sources. • Located at the base.
Body tube (Barrel)	• Connect the eye piece to the objective lenses.
Nose pieces	• It is rotating mounts that holds many objective lenses. It is movable, hence can change the magnification
Arm	• Used to carry the microscope.
Stage clip	• Holds the slide in place
Condensers	• Lenses that are used to collect and focus light from illuminator in to the specimen. • Found under the stage next to the diaphragm. • Ensures clear sharp images are produced with high magnification (400×)
Base	• The very bottom part • Base accomodate all part of the light microscope

1.5.2 Proper Caring, Handling a Light Microscope

- Carry the microscope properly
- Put your arm beneath the base.
- Hold the microscope upright at all time.
- Put clean and dry slide on the stage.
- Always focus on low power (4×) objective first even if you need high power magnification then change to higher
- Focus with the large coarse focusing knob, then when you have nearly got the image in focus make it sharp using the smaller fine - focusing knobs.
- Use immersion oil only with 100× objective (oil immersion lens) in place. use only one drop of oil.
- Use only the fine adjustment with the high - power objective
- Never closer the lens and the specimen, let them further apart
- Never touch the lens and the surfaces with any thing else.
- Lower the stage and then remove the slide when you are done
- Always clean the microscope when you are done. (Use alens paper and the alcohol)
- Always place the 4× objective over the stage.
- Turn off the light before prettify the microscope away

- Always place the occular (eye piece lens) towards the back of th cabinet.
- Always wrap the cord correctly before putting the microscope away.

1.6 General Laboratory Safety Rules

What is safety rules?

- Safety is the condition of being protected from harm of danger.
- Safety is the control of hazards.
- Laboratory safety is important before we do any activities in the laboratory.
- Working carefully in the laboratory.
- Keeping safety constantly in mid are some of the safety rules.

Important General Laboratory Saftey Rules are:

1. Follow the instructions:
   - ➥ From start to finish, how to use lab, equipments
2. Knowing the location of saftey equipments.
3. Dressing for the laboratory

Including: use goggles, gloves laboratory tom coat long pants, leath shoes (or boots) (no wear sandals), respiratory masks.

NB: The dressing procedure should be based on the nature of t experiments.

4. Never eat or drink in the laboratory
5. Never taste or sniff chemicals.
6. Handling chemicals properly.
7. Cleaning the experiment area in the lab every lab session should beg and end with chemicals, and equipments clean and properly.
8. Act responsibly in the laboratory
   - ➥ Never randomly mix chemicals to see what happens. It may explosion, fire or release of toxic gases.
9. All personnel should emphasis on saftey and chemical hygiene at tim
   - ➥ Never leave containers of chemicals open. All containers must have appropriate labels.
   - ➥ Unlabelled chemicals should never be used.

End of Unit Review Questions

Part I. Choose the Best Answer from the Given Alternative

1. One of the following is not true
   A) Electron microscope can be used in the laboratory
   B) Some light microscopes can be used in the field.
   C) Light microscopes gives better magnification than electron microscope.
   D) Light microscopes were invented before electron microscope.
2. Which one of the following is suitable equipment to separate solid particles from the liquids:
   A) Microscope
   B) Centrifuge
   C) Dissecting kit
   D) Balance
3. Field work is important in biology because biologists can gather information about:
   A) Individual organisms in their natural surroundings
   B) How organisms are distributed in a particular area
   C) How the organisms in an area are changed over time.
   D) All of the above.
4. Bacteria are usually cultured in:
   A) Test tubes
   B) Beakers
   C) Petri dishes
   D) Flasks
5. Pit fall traps are used to catch:
   A) Flying insects
   B) Small animals crawling on the ground
   C) Damaged plants
   D) Insects form long grasses.
6. Sweep net (insect net) is used to catch insects.
   A) Crowing on the ground
   B) From long grasses
   C) Damaged plants
   D) From wood or stem
7. When estimating the number of species in an area, biologist use quadrats that are:-
   A) Placed deliberately all over the area.
   B) Placed at random

C) Placed one after the other

D) Placed at regular intervals

8. Which one is not laboratory safety rule?

A) Hair fied back

B) Wear laboratory coat

C) Wear sandal shoes to cover your feet

D) Wear safety goggle and gloves properly

9. Which of the following is not a type of biologist?

A) Geneticist C) Astrophysicist

B) Entomologist D) Medical doctor

10. Biologists are trying to help deal with the problem of a growing population by:

A) Increasing the productivities of crops.

B) Giving advices to the most effective contraceptive methods.

C) Developing antibiotics, and other medicines to combat pathogens

D) Increasing the productivity of stocks

11. Which of the following is **Not** a dissecting tools:-

A) Scissors C) Forceps E) Magnifying glass

B) Scalpels D) Thermometer

12. Which one of the following is **not** the application of biology in our d to day activities?

A) Lactic fermentation

B) Alcoholic fermentation

C) Selective breeding

D) Production of antibiotics vaccines & enzymes

E) None

13. Which one of the following is **incorrect** about an optical microscop (light microscope) ?

A) Uses abeam of light C) Can be used in the laborat

B) Has a high resolving power D) Used beam of electron.

14. Which of the following is not the role of biological science:-

A) Looking in to nature

B) Investigating solutions for problems

C) Dis proving religious beliefs

D) Gaining knowledge

Part II Matching

A	B
15. Experiment	A) Used to see the internal organs of an animals
16. Autoclave	B) An equipment used to separate solid particles from liquid
17. Centrifuge	C) The process that scientists use in their investigations
18. Scientific method	D) A type of investigation that tries to establish caused and effects.
19. Dissecting tools	E) Equipment used to sterilize micro organisms by steam pressure.

Part III Fill in the blanks spaces for the following questions

20. A compound microscope with two eye piece lenses is known as _____

21. A type of objective lens of a compound microscope which has the a highest magnification power is ______

22. The ability of a microscope to show the detailed scattered parts of an object is known as ______

23. Fill the following table 1.5 by calculating the magnification

A) Objective lens magnification

B) Total lenses magnification C) Eye lens magnification

Eye lens Magnification	Objective lens Magnification	Total lens Magnification
5 ×	A	500 ×
× 10	40 ×	B
C	100 ×	1000 ×

Part IV Give short answer for the following questions

24. When choose an item of equipment to measure volume what should you mainly consider?

25. What is the image size of cell under a microscope having an eye piece lens of 10× and objective lens of 40×, viewed a cell having a size of 0.02 μm (0.02 micrometer) is seen.

26. Identify the major laboratory saftey rules?

27. Explain the major laboratory saftey rules.

28. Explain how to care, handle and use a light microscope?

Answer Key

End of unit Review Questions

Part I. Choose the best answer

1. C
2. B
3. D
4. C
5. B
6. B
7. B
8. C
9. C
10. B
11. D
12. E
13. D
14. C

Part II. Matching

15. D
16. E
17. B
18. C
19. A

Part III Fill in the blank spaces

20. Binocular

21. Oil immersion lens

22. Resolution

23. A 100× B. 400× C. 10×

Part IV Give short Answer

24. We consider the precision or accuracy to Which the instrument can measure.
    - Larger measuring tools can measure larger volume precisely.
    - The smell the measuring tools (like pipette) the precisely it measures smaller volume.

25. The total magnification power of a microscope os $10\times \times 40\times = \mathbf{400\times}$

    Thus, since the cell has an original size of $0.02\ \mu m = \mathbf{8\mu m}$ (micro meter)

    The magnified size of a cell is multiplied by $400\times$ will be $400\times \times 0.02\mu m = \mathbf{8\mu m}$ (micrometer) image size of a cell

UNIT 2

Characterstics and Classification of Organisms

2.1 Characterstics of Living Things

What are the characterstics of living Things?

The properties or characterstics of living things shared in common are listed in be how:

All living things are:

I. Made up of one or more cells:

- These are made up of one celled (single celled) are called unicellular organisms
- These are made up of many celled are called multicellular organisms.

II. Respiration: All livings things require energy.

- The process of releasing energy from food.

III. Nutrition: The process by which organisms obtain and utilize food to provide energy.

- Autotrophs: some organisms use sunlight energy to make food by the process of photosynthesis. They are called producers or autographs. E.g Plants & algac.
- Heterotrophs: Some organisms can not make their own food but

they consumer others. They are called hetrotrophs or consumers. E.g All animals, decomposers (all fungi and some bacteria).

IV. Irritability: are sensitivity to detect changes in the environment (internal or external).

- ➥ **Stimuli**: is changes in the environment that causes the organism to respond. E.g light, temperature (hot or cold), sound, etc.
- ➥ **Response:** is the reaction made by the organism against the stimuli.

V. Growth: is increase in size and mass.

VI. **Reproduction**: is the process of producing of off springs that of the same kind of organism.

- ➥ It can be asexually or sexually.
- ➥ It is very important to keep continuity of life

VII. Excretion: is the process of getting rid of metabolic wastes produced by the cell.

VIII. Display ordered complexity: All living things are both complex and highly ordered.

IX. Homeostasis:- is the process of maintaining the constancy of the internal affairs.

- ➥ Keeping the internal conditions more or less constant called homeostasis.

Example keeping constant body temperature, amounts of fluid, salt ions, glucose, etc.

X. Adaptation: all organisms interact with other organisms and with their environment for their survival.

- ➥ Features of organism developed which make it possible for them to survive in particular habitat is called adaptation.

2.2 Taxonomy of Living Things

2.2.1 Principles of Classification

Why do biologists classify living things?

There are many varieties of living things in the world. This is interns of species richness. The number of different species that are present in an ecosystem is called **biodiversity.**

There are more than 5 millions types of varieties of species of organisms in the world. But only 1.75 millions of them can be identified and studied.

To help us understand such a great varieties of living things we put them in to group. This grouping of similar living things is known as **classification.**

- The science of identifying, classifying and naming organisms is called **taxonomy.**
- Scientists who study taxonomy are called **taxonomist.**
- Biologists identify, classify, and naming of organisms based on their structures:
  - ➥ Morphological
  - ➥ Physiological
  - ➥ Behavioural
  - ➥ Ecological
  - ➥ Cell stucture
  - ➥ Nature of cell wall
  - ➥ Mode of nutrition
  - ➥ Methods of reproduction
  - ➥ Body organization
- The genetic make up of organism and evolution ary relation ship are also helps in classification.
- Biologist classify living things for the following reasons.
  1. To simplify their study (Easier to understand).
  2. To bring order out of chaos or confusion.
  3. To try understand how life originated

The most important unit of classification is the species.

Species: A group of organisms that can breed successfully with one another to produce fertile offsprings is called **species.**

- ➥ Species is the smallest natural group of organisms.
- ➥ Members of a species are resemble each other very closely in appearance

- Scientific name are needed in study of organisms, since it helps all the taxonomists to have a common understanding by replacing the common names used by different languages.
- Common names are names given to organisms by different languages.
- Scientific name is important because one species of an organism has only one scientific name which helps scientists of different countries to have common understanding.

Rules for Writing Scientific Names

1. The first name is the name of the genus to which the organism belowgs.
   - ➥ The first letter written in capital letter.

- Some times reduced to capital letter.

  E.g *Homo Sapiens or H. sapiens*

2. The second name is the name of the species to which the organism belongs
   - The first letter written in small letter
3. The two name are underlined when handwritten or in italics when printed.

2.2.2 Taxonomic Hierarchies In Biological Classification

What is taxonomic hierarchies?

Taxonomic hierarchy is the process of arranging various organisms in to successive level of biological classification in a decreasing or increasing order.

In the linnaean classification system, all organisms are placed in a ranked hierarchy.

- From the kingdom down wards to the species. The kingdom is the wider or broader level ranked the highest,
- The species is the narrow lowest unit in classification **carolus linnaeus** (177 - 1778) a Swedish botanist, who is also known as the father of taxonomy, introduced a taxonomic hierarchy of classification. He was the first person to propose an orderly system for classifying organisms.

Each rank in a taxonomic hierarchy is termed as tax or (plural taxa). Linnaeus developed a two kingdom system of classification. He classified all living things in to two king system of classification (Plants and animals). But the two kingdom system of classification do not suit to classify all living things. linnaeus made a number of change in classification:

1. Linnaeus classified plant kingdom and animal kingdom in to more groups.
2. He based his system on specific characters.
3. He gave organisms name that describe their character. These names had two parts, these are the genus name and the specific name.

Based on the natural classification method (Biological). The system of scientific name of organisms is called **binomial system of nomenclature.** Binomial means two names. This binomial system of nomenclature is by using two Latin words, the first word is the genus name, and the second name is the species name.

Example

The scientific name of Ethiopian wolf is *canis simensis*

The Modern Classification Method:

There are seven groups for classifying organisms king dom → Phylum → Class → order → family → Genus → Species.

Having more groups makes it easier to place an organism in the proper group.

On the broaderst level, biologist divide the diversity of life in to three domains: These three domains are

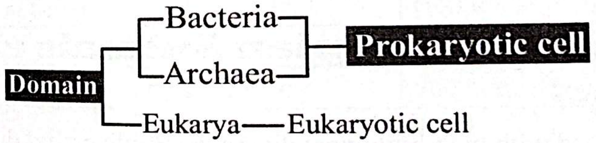
canis simensis

- Bacterla
- Archaea and
- Eukarya.

Every organisms on the earth belongs to one of these three domains.

Domain → Kingdom → Phylum → Class → Order → Family → Genus → Species.

The three domains are also further classified in to two prokaryotic cell and eukaryotic cell



- Domain is the rank above the kingdom.
- **Prokaryotic cell**:- a cell with no nucleus.
  - a cell with non - membrane bound compartments.
  - Very small and simple cell:
  - They belong to the domains of bacteria and Archaea.
  - Archaea are more closely related to eukaryotes than to bacteria.

Eukaryotic Cells: relatively large and complex cells.

- Contain nucleus and other compartements with membrane - enclosed structures.
- They are grouped in to the domain Eukarya.
- The domain eukarya includes groups such as protists, fungi, plants

and animals.

Eukarya → Animalia → Chordata → Mammalia → primata → Humindae → Homo → sapiense.

Domain → Kingdom → Phylum → Class → Order → Family → Genus → Species.

Domain ⟶ is the rank above the kingdom.
↓
Kingdom ⟶ Organisms of similar or related phyla are grouped to kingdom.
↓
Phylum ⟶ Organisms of similar or related class are grouped to phylum.
↓
Class ⟶ Organisms of similar or related order are grouped to class
↓
Order ⟶ Organisms of similar or related family are grouped to order.
↓
Family ⟶ Organisms of similar genus are grouped in to family.
↓
Genus ⟶ Organisms if similar species are grouped in to genus
↓
Species ⟶ Groups of organisms that can interbreeds and produce fertile offsprings.

2.3 Common Ethiopian Animals and Plants

Ethiopia is endowed with high biological diversity (Biodiversity) due to its ecological diversity, (gographical and topograpical diversity as well as diverse climatic features)

- The country has diversified species of plants and animals, with a high degree of endemicity.
- Ethiopia has a centre of diversity for field crops such as noug *(Guizotia abyssenia)*, teff *(Eragrostis tef)* and the Ethiopian mustard *(Brassica carinata)*
- Besides field crops such as barely, sorghum durum wheat, finger millet, faba bean, chick pea, lentil and cow pea have wide diversity in Ethiopia.

Table 2 . 1 The scientific Names of some common plants and Animals In Ethiopia /Hierarchy of Groups/

	Ethiopian Wolf	Lion	Geladeba boom	Walia Ibex	Enset	Teff	Noug	Domestic Cat	Human
Kingdom	Animalia	Animalia	Animalia	Animalia	Plantec	Plantec	Plantec	Animalia	Animalia
Phylum/ Division/	Chor date	Chor date	Chor date	Chor date	Angiosperata	Angiosperata	Angiospermata	Chor data	Chor data
Class	Mammalia	Mammalia	Mammalia	Mammalia	Monocy lodoneac	Lilo spida	Eudi cots	Mammalia	Mammalia
Order	Carnivora	Carnivora	Primate	Dactyla	Zingib erales	Cyperales	Asterceae	Carnivora	Primate
Family	Canidac	Felide	Cerco pithecidac	Bovida	Muss aseae	Poacea	Asterceae	Felidac	Himunid
Genus	Canissimensis	Pantheraleo	Theropithecus	Capra	Ensete	Eragrotes	Guizotia	Felis	Homo
Species	Canissimensis	Pantheraleo	Theropithecus	Capra walie	Enset ventrico sum	Eragrostis teff	Guizotia abyssinica	Felis domesticus	Sapiens

Table 2 . 2 Scientific Name of Some Organisms

Common Name	Scientific Name	Genus Name	Species Name
Domestic cat	Felis domesticus	Felis	domesticus
Dog	Canis familaris	Canis	familiaris
Human being	Homo Sapiens	Homo	sapiens
Koss tree	Hagenia abyssinica	Hagenia	abyssinca
Lion	Panthera leo	Panthera	leo
Maize	Zea mays	Zea	mays
Teff	Eragrostis tef	Eragrostis	tef
Noug	Guizotia abyssinica	Guizotia	abyssinica
Enset	Ensete ventricosum	Ensete	ventricosum

Scientific name is important because one species of an organism has only one scientific name which helps scientists of different countries to have common understanding.

Conceptual Examples

Part I Give short Answer

1. Why important to classify organisms?

Explanation

The natural method of classification which is mainly based on the evolutionary relation ship and their genetic make up is important because:

- To study the relation between organisms
- To place them ingroups based on their similarites and differences.
- To simplify their study (Easier to understand.
- To bring order out of chaos or confusion.
- To try to understand how life originated.

2. A group of organisms consisting of one or more genera is a:

A) Family B) Species C) Genus D) Class

Explanation

- Similar species are grouped in to a genus
- Similar genera are grouped in to a family

Answer: A

3. What statement can be made about members of the same order?

A) They all belong to the same genus.
B) They all belong to the same class.
C) They can all interbreed successfully.
D) They all belong to the same family.

Explanation

Similar order are grouped in to the same class

Answer: B

4. Why are scientific name more acceptable than the common names in the study of classification of organisms?

Explanation

Common names are names which are given to an organism by different languages. Thus, scientific name which are name given to organisms by scientists and it helps scientists all over the world to

have common understanding.

5. The ability to interbreed in nature and produce fertile offspring is the characterstics of members of a single ________

Explanation

Species is the lowest taxonomic hierarchy.

2.4 The Five Kingdom System of Classification

- The most widely accepted system of classification is the five kingdom system.
- It is introduced by an American biologist called R.M whit taker (1969).
- The main criterion for the classification used by him include cell structure, body organization, mode of nutrition, reproduction and phylogenetic relationships.
- The five kingdom system of classification that R.H whit taker classified consistes of:

1. Kingdom; **monera:**
   - Consistes of bacteria and blue green algae
2. kingdom: **protista (or protoctistes)**
   - Consistes of eukaryotic single celled organisms called protozans, and some single celled & some multicellular eukaryotes algae,
3. Kingdom; **Fungi**
   - Consistes of eukaryotic, non - photosynthetic single celled yeast and multicellular moulds, mushroom, mucor, etc
4. Kingdom **Plantae**
   - Cosistes of all multicellular, eukurytic, and autotrophic plants.
5. Kingdom **Animalia**
   - Consistes of all multicellular, eukaryote and thyrotrophic animals.

Viruses

- Viruses are not included in any kingdom.
- They are not considered to be living organisms
- Because they lack key characterstics of living organisms.
- Viruses are particles that are not a live (obligatory parasites)

CS CamScanner

- They causes diseases and infections.
- Viruses are made up of nucleic acids, either DNA or RNA (but not both), surrounded by protein coat called capsid.
- They are smaller than the smallest cells known (bacterium).
- Most biologist are that viruses are not a live because they don't grow, or developed, or carry out respiration.
- All viruses replicate, or make a copies of themselves only in living cells.
- They can not replicate in non - living things.
- Viruses in order to copy themselves they must enter the living cells.
- The cell in which a viruses replicates is called the host cell.

Conceptual Example

1. Explain the characteristics that viruses share with living things in common.

Explanation

They contain genetic materials that is nucleic acids, either DNA or RNA in common

2. Write the general characteristics of viruses.

Explanation

- ➥ Viruses are very small, even smaller than the smallest cell known (bacteria).
- ➥ All viruses are obligatory parasites.
- ➥ They contain genetic material (DNA or RNA & protein coat).
- ➥ No respiration
- ➥ Replicate only in living cell.

1. Kingdom Monera

What are the major distinguishing characteristics of kingdom monera?

Explanation

- Mon era includes eubacteria (called true bacteria) and archaebacteria.
- Eubacteria have strong cell wall made up of peptidoglycan.
- They are prokaryotic cell, with no nucleus and no membrane enclosed compartiments.
- They are unicellular

- The representative groups are eubacteria (true bact) and cyanobacter (blue - green algac).
- Nutritionally they are either autotrophic (blue - green algac) and hetertrophic (bacteria)
- They reproduced by asexually by fragmentation and binary fusion.
- Some of them are useful in decomposition and the recycling of nutrients such as nitrogen cycle, carbon cycle, etc.
- Some of them are harmful. The harmful aspects are pathogens (causes diseases) like *mycobac terium tuberculosis* (TB) and *clusterdium tetani* (cayses tetanus - lock jaw).

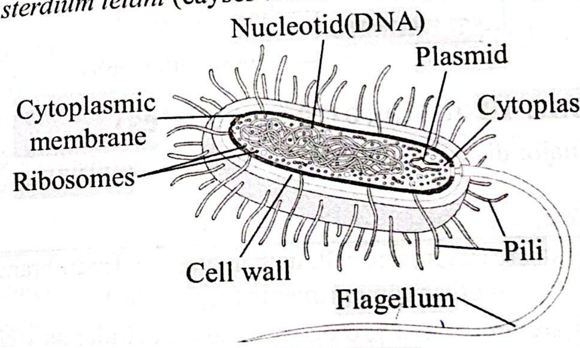


Fig 2.1 Structure of Bacteria

Shapes of Bacteria

- Bacteria can be classified on the bases of their shapes.
- There are three types of bacterial shapes: These are :

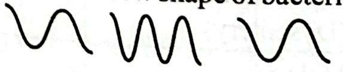
i. **Spherical shape-** Spherieal shape of bacteria are called coccus (plural. cocci)

ii. **Rod** - shaped

➥ The rod - shaped bacteria are called bacillus (plural bacilli)

iii. **Cork - screw shaped**

➥ The cork - screw shape of bacteria are called spirila or spirochates.

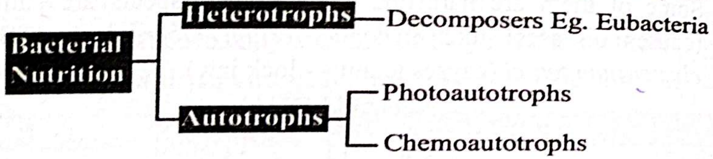


Photoautotrophs:- They make their own food.

- They are photosynthetic bacteria
- They derive energy from sun light.
- Example: Blue green algae (cynobacteria)

Chemoautotrophs:- They make their own food

- They are chemosynthetic bacteria.
- They derive energy from chemical reaction.
- Example: sulphur bacteria, Thermophilic bacteria, etc


Bacterial Nutrition
Heterotrophs
Decomposers Eg. Eubacteria
Autotrophs
Photoautotrophs
Chemoautotrophs

2. Kingdom: Protista (or protoctistes)

What are the major distinguishing characterstics of protista?

Explanation

- They all are eukaryotic cell, with nucleus and membrane enclosed nucleus and other compartments (organelles)
- They are unicellular protozoans and unicellular as well as some multicellular algae.
- Representative groups of this kingdom are **sub kingdom protozoa** and **sub kingdom algae.**

Sub kingdom: Protozoa

They are : Unicelluar

- No chlorophyll
- No cell wall
- They live as a parasite or free living.

Table 2.3 Protozoan Mode of Living and Locomotion

Protozoan	**Locomotion**	**Parasite (Diseases causing)**	**Free living**
Amoeba	Pseudopodia	Amoeba *histolytica* (Dysentery)	-
Plasmodium	No	Malaria	-
Paramecium	Cilia	-	Freeliving
Giardia	Flagella	Diarrhoe	-
Trypanosoma	Flagella	Sleeping sickness	-
Euglena	Flagella	-	Autotrophs (chlorophyll) Hetertrophs (animal)

Sub - kingdom protozoan consistes of the following phylla:

- Phylum: **mastigophora:** consistes of amoeba and flagellates like giardia & trypanosomes
- Phylum: **Ciliophora:-** Consister of ciliated like paramecium
- Phylum: **apicomplexa**: consistes of plasmodium, causative agents of malaria.

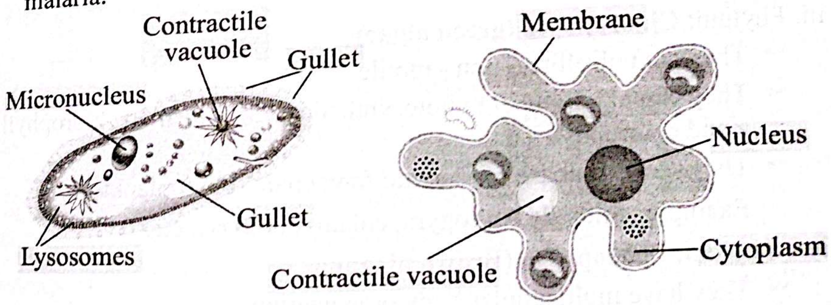

Contractile vacuole
Gullet
Micronucleus
Gullet
Lysosomes
Membrane
Nucleus
Cytoplasm
Contractile vacuole

Fig 2.2 paramecium and Amoeba

Sub kingdom: Algae

- They are photosynthetic and eukaryotic
- Usually live in aquatic habitat, wet area
- They lack true leaves, roots and stem
- Sub kingdom Algae consistes of the following phyla:

i. Phylum: **Dinoflagella**

- They have yellow - brown pigment
- They have flagella for locomotion
- Examples: aryptomonas, ceratium.
- They causes bioluminescence in the sea and oceans, That what is

produce greenish light.

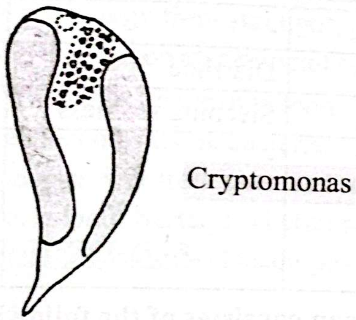


Fig 2.3 Cryptomonas

ii. Phylum: **Bacillariophyta (Diatoms)**

- They have yellowish - brown pigment.
- They are photoplankton (sources of food for aquatic animals).
  E.g Diatoms

iii. Phylum: **Chlorophyta (green algae)**

- They are unicellular, non - motile
- They contain dominant photosynthetic pigment called chlorophyll a and chlorophyll - b.
- They serve as abase for aquatic food chain (phytoplankton).
  Example: chlorella, spirogyra, chlamydomonas, etc.

iv. Phylum: **Phaeophyta (Brown algae)**

- They have multicellular body organization
- They have dominant photosynthetic pigment which is brown and called Fucoxantin.
- It is used as thickning agents in icecream and cosmotic industries.
- They are rich in iodine content which can be used for human consumption.
- Example : Fucus, laminaria

v. Phylum **Rhodophyta (red algae)**

- Have multicellular body organization with fine mentous or feathery bodies.
- Some are unicellular.
- In addition to chlorophyll, they also contain additional red pigmented substance called **phycoerythrin.**

- They are the main constituents of **agar** which is a solid nutrient medium (culture medium for bacteria).
- Economically they are also be used as a constituents in making laxatives and tooth paste.

vi. Phyium: **Euglenophyta**

- They are unicellular flagellated Euglena.
- They share both plants and animal characterstics in common.

Their common characterstics with plants are:

- Have cellulose cell well.
- They contain chloroplast (Chlorophyll) for photosynthesis.
- Their Animal - like characterstics includes:
- Have an eye spot for detecting the direction of light.
- Serve as a sources of food for some aquatic animals
- Nutritionally heterotrophic (absorb nutrients dissolved in water).
- Have flagella for locomotion.
- Serves as an indicator of pollutants.

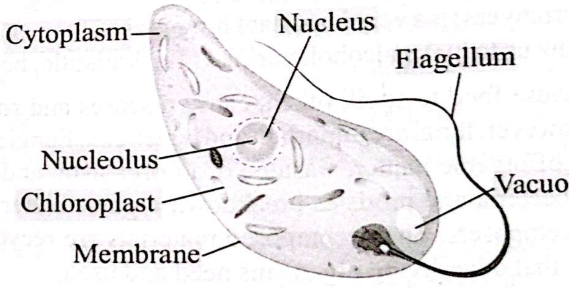


Fig 2.4 Structure of Euglena

3. **Kingdom: Fungi**

- Fungi consistes of the unicellular **yeast** and multicellular groups like mushroom, mucor, Rhizopus, mould, etc.
- The study of fungi is called mycology.
- They have rigid cell wall made up of anitrogen containing polysaccharide called chitin.
- They have heterotrophic mode of nutrition.
- They lack chlorophyll and they do not make their food
- They store food in the form of glycogen like animals.

- They can be parastic, saprophytic or mutualistic mode of life.

Mutualistic fungi:-Mycorrizae: the association between fungi and plants roots

- Lichens: the symbiotic association between algae and fungi.
- The relationship is called mutualism.
- Mutualism means living together for common benefits.

Saprophytic fungi: They feed on dead organic matter

- The digestion of dead matter is out side their body called extracellular digestion. Their mode of nutrition is called saprobiontic nutrition
- They are decomposers.

Parasitic fungi : feed on living tissues of plants and animals.

Example: *Candida albican* - thrush fungi *Tania pedis* - Athlets' feet fungi mildew fungi - Plant parasitic Fungi can reproduce either by vegetative means (fragmentation, fission and budding), asexual reproduction through spore are formation and sexually.

The various spores are produced in distinct structures called fruiting bodies.

Yeast (Saccharomyces) is a very important fungus used for making injera and braed and allow us to make alcoholic drinks (Tej, katikalla, beer, wine etc).

Some fungi cause food to spoil, others cause diseases and some are even poisonous. However, fungi are important and beneficial. Fungi are important decomposers of organic matter, wasters, dead organism, and dead plants. Many fungi, bacteria and protistes breakdown organic materials and they are called decomposers. The decomposed materials are recycled in to the raw materials that other living organisms need and used.

Kingdom Fungi consistes of Three major phyla:

- Phylum: **Zygomycota:** includes rhizopus, mould and mucor
- Phylum: **Ascomycota:** Yeast, mildews
- Phylum: **Basidiomycota**: A garicus campestris, mushroom.

Supplementary Exercise

Part I Choose the Best Answer from the Given Alternatives

6. When you compare kingdom protista in five kingdom system of classification, protista does not include

A) Amoeba B) Fungi C) Algae D) Paramecium

7. In which of the following kingdoms are prokaryotic organisms placed?

A) Fungi B) Protista C) Plantea D) Monera

8. Which one of the following is not true about kingdom monera. They are

A) Unicellular C) Multicellular

B) Prokaryotes D) Contain bacteria:

9. The locomotary structure of euglena is:

A) Cilia C) flagella

B) Pesudopodia D) Antennae

10. All of the following are fungus, except:-

A) Yeast C) Plasmodium

B) Rhizopus D) Mushroom

11. One of the following is not belongs to eukaryotes:

A) Kingdom protista C) Kingdom fungi

B) Kingdom monera D) Kingdom animalia

12. Nearly all single celled eukaryotes that are either heterotrophic or photosyntheitic belong to the kingdom (EGCECE 1997 E.C)

A) Fungi C) Protista

B) Animalia D) Plantac

13. Which of the following is correct about *Felis domesticus?*

A) It is a common name C) Domesticus is a genus name

B) Felis is a genus name D) It is anenglish word to name domestic cat

14. Bacteria are different from organisms of other kingdoms by?

A) Mode of nutrition C) Prokarytic cellular nature

B) Asexual repoduction D) Having nucleus

15. Groups of organisms that can interbreed successfully with one another to produce fertile offsprings are ______

A) Kingdom B) Species C) Pylum D) Class

Answer key

For supplementary Exercise

6. B 8. C 10. C 12. C 14. C
7. D 9. C 11. B 13. B 15. B

Conceptual Examples

16. Why are monera so different from organisms of other kingdoms?

Explanation

Organisms of kingdom monera differ from other kingdom since they are only prokaryotic groups.

17. List the locomotary organs of the following eukaryotic protista?

Amoeba, Euglina, paramecium, Guardia, trypanozoma, plasmodium.

Protozoan	Locomotary organs
Amoeba	Pseudopodia
Euglena	Flagella
Paramecium	Cilia
Guiardia	Flagella
Trypanosoma	Flagella
Plasm odium	No locomotary organs

4. Kingdom : Plantae

- Plant kingdom includes all eukaryotic, multicellular and autotrophic organism.
- The major characterstics of plant are:

They are :- Eukaryotic cells

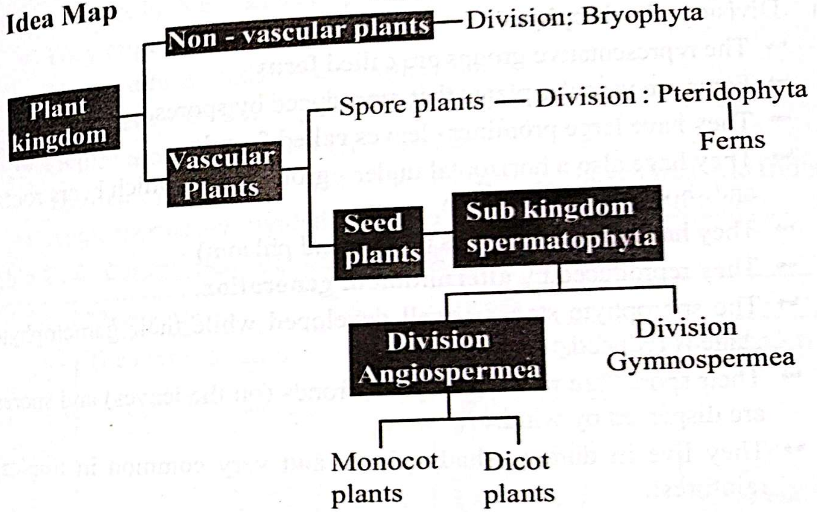
- Multicellular organisms
- Contain chloroplast.
- Chloroplast contain a green piment which is essential to carry out the process of photosynthesis called chlorophyll.
- They are autotrophic organisms (primery producers)
- Their cells contain rigid cell wall, which is made up of cellulose.

- They are vascular or non - vascular plants.
- They produce by sexually and asexually.
- The asexual reproduction are by vegetative propagation.
- They are predominantly land dwellers.

The plant kingdom consistes of the following divisions:

Vascular Plants

Idea Map


Non - vascular plants
Division: Bryophyta
Plant kingdom
Spore plants
Division : Pteridophyta
Ferns
Vascular Plants
Seed plants
Sub kingdom spermatophyta
Division Angiospermea
Division Gymnospermea
Monocot plants
Dicot plants

Key Terms

Vascular plants: These plants containing vascular tissues. (Xylem and phleom tissues)

- Xylem and phleom tissues are transport tissues.
- **Xylem tissues:** are a transporting tubes that carries and transport water and minerals absorbed from the soil by their roots up in to the stem and leaves.
- **Phleom tissues:** are tubes that transport ready - made foods (carbohydrates and proteins) in the leaves to other parts of the plant parts.
- The plant kingdom consistes of the following divisions:

i. **Division Bryophyta**

- Representative groups are mosses and liver worts.
- They are simple and green land plants.
- Example mosses, liver worts, etc

- They have no true root, stem and leaves.
- They are non - vascular plants.
- They have simple leaves.
- They have simple root - like structures called Rhizoid, used for absorption of water and minerals.
- They are commonly found in rain forests and high altitude mountain areas.

ii. Division: **Pteridophyta**

- The representative groups are called **ferns**
- Ferns are vascular plants that reproduced by spores.
- They have large prominent leaves called **fronds**
- They have also a horizontal under - ground stem which bears roots and shoots called **rhizome**
- They have vascular tissues (xylem and phleom)
- They reproduced by **alternation of generation.**
- The sporophyte stage is well developed while their gametophyte stage is reduced.
- Their spores are produced by the fronds (on the leaves) and spores are dispersed by wind.
- They live in dumpy, shady places and very common in tropical rainforest.

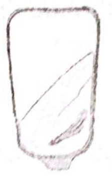
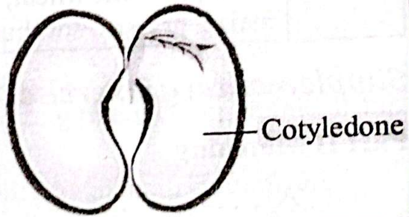
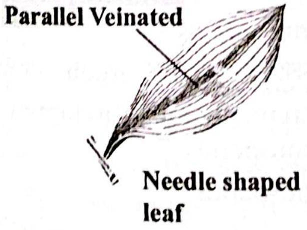
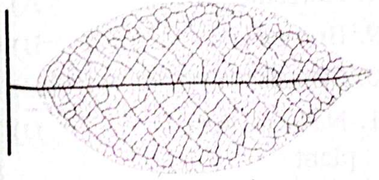
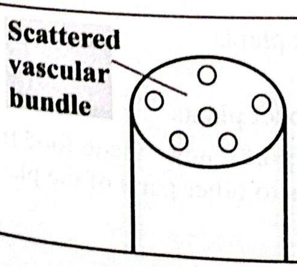
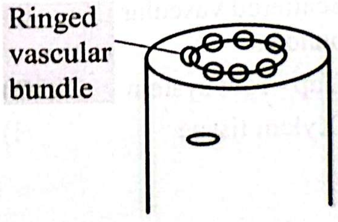
iii. Division **Gymnospermae**

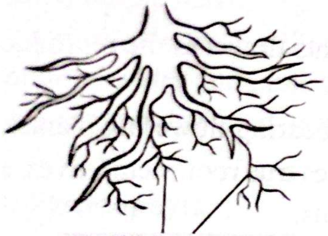
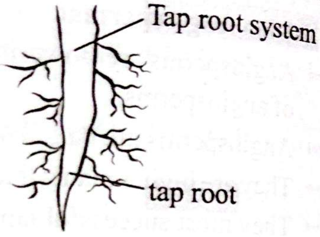
- Gymnospermae are seed - bearing non - flowering plants. They are higher plants.
- They have well developed stem, leaves & roots.
- They are naked seeded. which means the ovules are unprotected by ovary. The ovules (seeds) are not enclosed in the fruits (ovary).
- They are vascular plants.
- Their reproductive structure are found in structure called cones (the male cone and the female cone found in different parts of the same plant).
- They leaves are needle shaped and ever green.
- Example of gymnosperm, Indigineous to Ethiopia are *Juniperous procera* (Tid) and *podocarpus falcuts* (Zigba).
- The largest groups of gymnosperms are **conifers.**

iv. Division **Angiospermae**

- Angiosperms are flowering plants flower is the reproductive organ of angiosperms
- Angiosperms are called seed - bearing flowering plants.
- They are higher plants that posses true root, stem leaves. and flowers.
- They most successful land plants.
- They produce seeds covered with fruits.
- They have well developed vascular tissues.
- Ovules are protected with in the ovary.
- The ovules are developed in to seeds and ovary developed in to fruits.
- Angiosperms are divided in to two classes: monocots & dicots.

Table 2 . 4 **Comparison Between Monocots & Dicots**

	Monocots	**Dicots**
Seed	The embryo has one cotyledone. 	The embryo has two cotyledon 
Leaves	 	 Net veinated Have broad leaved
Stem	 	

Roots	 Fibrous or adventitious roots	
Flower	Flowers are 3's or multiple of 3	Flowers are arrenged in 4's or 5's or multiple of 4 and 5 arrangement
	Have true secondery growth, with vascular cambium is absent	Have true secondary growth, with vascular cambium present
	Example: Teff, wheat, maize, grasses, sorghum	Example: Bean, peanut, coffee, checkpea, pea, bea

Supplementary Exercise

Part II Matching

A	B
18. Rhizome	A) Simple and green land plants
19. Bryophyta	B) Gymnosperms
20. Cones	C) a horizontal underground stem in ferns
21. Naked seeded plant	D) The reproductive sturcture in gymnosperms
22. Seed - bearing flowering plants	E) Angiosperms
23. Scattered vascular bundles	F) Dicot plants
24. Tap - root system	G) Monocot plants
25. Xylem tissue	H) Transport ready - made food from the leaves to other parts of the plants
26. Phleom tissue	I) Transport water and minerals from the roots to the stem and to the leaves.

Answer Key for Supplementary Exercise

18. C
19. A
20. D
21. B
22. E
23. G
24. F
25. I
26. H

Conceptual Examples

27. List some importance of plants that provide for us?

Explanation

Plants are important:

- Sources of food (like teff, wheat, fruits, vegetables, soyayean, lentil, peanut, etc).
- Ecological balance.
- They provide oxygen as a by products of photosynthesis
- Some plants provide us medicine
- Some are economical importance. They provide raw material for industry like timber, rubber tree etc.
- Some plants are a sources of fabrics (e.g linen, cotton, ramie, hemp & burlap).
- Some are important for construction, ornamental, cultural, etc

28. List out the common characterstics of plants.

Explanation

All plants have the following common features:

They are:- Eukaryotes, multicellular & autotrophs
- Cellulose cell wall & have chlorophyll.
- They reproduce by a sexually and asexually by vegetative propagation.

29. Distinguish between:

i. Gymnosperms and Angiosperms

ii. Monocots and dicots.

Table 2 . 5 Explanation

Gymnosperms	Angiosperms
• They bear no flowers.	• They bear flowers
• Seeds are naked seeded and not enclosed in fruits	Seeds are enclosed in fruits
There reproductive structures are found in cones	Their reproductive organs are flowers
Leaves are needle shaped and ever green	The most successful land plants
• Less diversified species	The most diversified speciies of plants.
They are conifers (Tid and Zigba)	• All flowering plants belong (monocots & dicots)

Table 2 . 6 Explanation

Monocots	Dicots
• One cotyled one	Two cotyledone
• Parallel veinated leaves	Net veinated leaves.
• Scattered vascular plants	ringed vascular plants
• Have fibrous or advetitious roots	Have tap root system
• Have floral parts in 3's	Have floral parts in 4's or 5's
• Vascular cambium is absent	Vascular cambium present.

Supplementary Exercise

Part III Choose the Best Answer from the given Alternatives.

30. Monocots differ from dicots by all of the following except:-

A) Have one cotyledone
B) Have narrow leaves with parallel veinated
C) Have fibrous or adventitious roots
D) Vascular cambium present.

31. Gymnosperms do not differ from angiosperms by:

A) They bear no flower
B) Their seeds are naked and not enclosed in the fruits
C) Their reproductive structure are found in cones.

D) They used sexual mode of reproduction.

32. Which of the following are vascular plants?

A) Mosses B) Ferns C) Algae D) Liver worts

33. Which of the following is true about gymnosperms?

A) Flower C) Seeds enclosed in ovary
B) Vessels in xylem D) Needle shaped leaves.

34. All of the following are examples of monocots except

A) Wheat B) Bean C) Teff D) Maize

35. Which one of the following structure is unique to Angiosperms.

A) Stem B) Root C) Flower D) leat

36. Appearance of net - vienated on leaves in the characterstics of

A) Mosses B) Ferns C) Monocots D) Dicots

Answer key

For supplementary Exercise

30. D 31. D 32. B 33. D 34. B 35. C 36. D

5. Kingdom: Animalia

- Animal kingdom cosistes of multicellular, eukaryotic, heterotrophic organisms.
- Their body has complex organ system.
- They have no chlorophyll and no cell wall.
- They feed by ingesting the food materials.
- They reproduce sexually and some reproduce a sexually.
- They exhibit locomotion.
- They have nerve system and sensitive to their surroundings.

Animals are grouped in to two: These are

A) Vertebrates: Animals with back bone

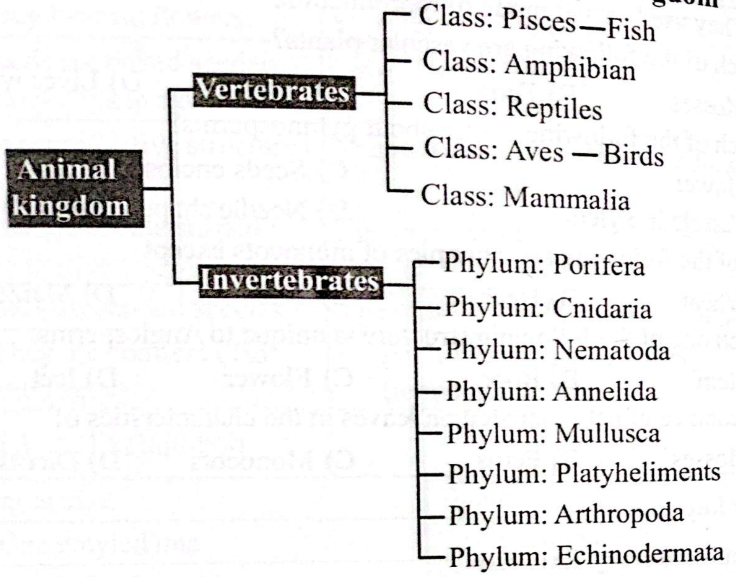
- These include chordata

B) Invertebrates:- are animals with out back bone

- All animal phylla belongs to invertebrates except phylum chordata.

Idea map

Classification of animal kingdom


Animal kingdom
Vertebrates
Class: Pisces—Fish
Class: Amphibian
Class: Reptiles
Class: Aves —Birds
Class: Mammalia
Invertebrates
Phylum: Porifera
Phylum: Cnidaria
Phylum: Nematoda
Phylum: Annelida
Phylum: Mullusca
Phylum: Platyheliments
Phylum: Arthropoda
Phylum: Echinodermata

Phylum: **Porifera (Sponges)**

- ➥ The simplest of all invertebrates
- ➥ They have no nervous system & no muscle.
- ➥ They have hollow filter feeder
- ➥ Reproduction are hermaphroditic
- ➥ They are evolutionary dead end and have no close living relatives.
- ➥ Live in water.

Phylum: **Coelentrata (cnidaria)**

- Their body consistes of two layers: ectoderms (outer layers) and endoderms (inner layer).
- Some have stinging tentacles, poisonous.
- One body opening
- They are radial symmetrical body
- Live in water

Example Jelly fish

Phylum: **Nematoda (Round Worms)**

- Representative groups are Ascaris, hookworm, pine worm, filaria
- They are round worms

- Have cylinderical body
- Have bilateral symmetrical body
- Have no circulatory system,
- Have complete digestive system.

Phylum: **Annelida**

- ➥ Segmented worms (segmented body).
- ➥ Complete digestive and simple nervous system.
- ➥ Have closed circulatory system.
- ➥ They have structure which is called chaetae projections found on every segments for locomotion.
- ➥ They are free living found in moist soil & water (parasite)
- ➥ Have two body opening
- ➥ Example: Earth worm, leech.

Phylum: **Mollusca**

- Soft body animals
- Body covered with shells
- Have true body cavity having reproductive structure, kidney and heart.

Example Snail, octopus, squid

Phylum: **Platyheliments (flat worms)**

- ➥ Have flattened body with mouth but no anus.
- ➥ Have no internal body cavity.
- ➥ They used diffusion for material transport.
- ➥ They are hermophrodites
- ➥ They live as parasitic or free living

Example: Tapeworm, planaria, liver flukes.

Phylum: **Arthropoda**

- They are jointed legs
- Have more body sections
- Have exoskeleton consistes of chitin.
- The most diversified species of animal
- Have open circulatory system.
- Have body cavity
- Consistes of five major classes based on number of limbs, presence or absence of antennae and number of body parts:

i. Class: Arachinida
ii. Class: crustecia
iii. Class: Insects
iv. Class: Chilopoda
v. Class: Diplopoda

Class: **Arachinida**

- Body divided in to cephalothorax and abdomen regions.
- Have four pair of legs and no antennae.
- Gas exchange by tracheal system.

Example: spider, scorpion, Tick and mites

Class: **Insect**

- Numerous groups of all arthropods.
- Body divided in to head, thorax and abdomen.
- Consistes of a pair of antennae, three pairs of legs one or two pairs of wings and compound eyes.
- Breathing by tracheal system and excrete by means of malphigian tubules.

Example: flies, butter flies, moths, beetles, wasps, bees, etc.

Class: **Crustaceans**

- They have two body parts cephalothorax (head fused with thorax) and abdomen
- Have four pairs of jointed legs.
- Have two pairs of antennae (unique to crustaceans)

Example: lobsters, crab, water flea, crayfish, shrimp, etc.

Class: **Chilopoda**

- Have long and flattened body
- Have a pair of antennac, pair of jaws, pair of legs per segment.
- Breathing by tracheal system and excrete by means of malphigian tubules.

Example: Centipedes.

Class: **Diplopoda**

- ➥ Have long cylinderical body
- ➥ Have a pair of segmented antennae and two pairs of legs per segments.

- ➥ Tracheal system is used for respiration and malphigian tubules for excretion.

Example: Millipeds.

Phylum: **Echinodermata**

- They are spiniy - skinned animals
- They are triploblastic
- Have mouth, gut and anus
- All are marine animals
- They are radially - symmetrical.

Example: Star fish, sea cucumber, Asteris

Supplementary Exercise

Part IV Match the following phylas of kingdom Animalia with their Respective Matches.

A	B
37.Porifera	A) Soft - bodied animals
38.Platyheliments	B) Joint - footed animals
39.Nematoda	C) Sponges
40.Annelida	D) Cnidaria
41.Mollusca	E) Round worms
42.Echinodermata	F) Spiny - skinned animals
43.Arthropoda	G) Segmented worms
	H) Flat worms

Answer Key

For supplementary exercise

37. C 38. H 39. E 40. G 41. A 42. F 43. B

Phylum: **Chordata**

- They consistes of animals with back bone.
- Sub - phylum: vertebrata
- They are animals with back bone.
- They have the following common features:

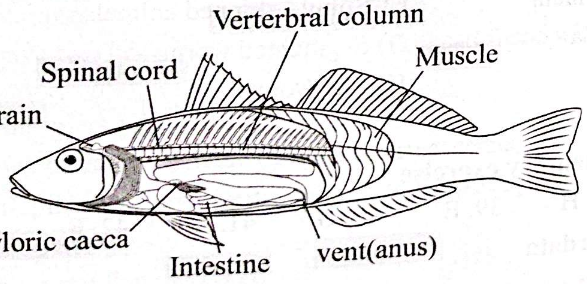
- Closed circulatory system
- Two pairs of limbs.
- Endoskeleton (Internal skeleton).
- They have notocord, gill slite and tail at the early stages of embryoni development.

Sub - phylum : **Vertebrata have the following classes:**

Class: Fish (Pisces)
Class: Amphibians
Class: Reptilia
Class: Aves (Birds)
Class: Mammalia

Class: **Fish (Pisces)**

- Body with stream - lined scaly skin
- Have four fins for swimming
- Live in water
- Breathe by gills
- External fertilization
- They are poikilothermic animals
- The hearts have two chambers (one auricle & one ventricle)



Class: **Amphibians**

- The word amphibians is derived from two Greek words, amphi - which means both and bios - which means life. This is because amphibians spend their life in water (tade pole) and on land (the adult).
- They are the first vertebrates that colonize the land.
- Breath by simple sac - like inefficient lung and moist skin.
- Reproduction is external in the water where sperms and eggs fertilized

- They are poikilothermic (endothermic)
- Their life cycle includes metamorphosis which includes the larva to adult stage.

Example: Frog, toad, salamanders.

Class: **Reptilia**

- Body covered with scales - horny scales
- Breath by their lungs.
- Fertilization is internal and they lay eggs.
- They are poikilothermic

Example lizard, snake, tortoise, crocodiles

- Dinosaurus are reptiles

Class: **Aves (Birds)**

- Body covered with feathers and scaly legs.
- Two pairs of pentadectyle limbs present (two of them are wings and two are legs.
- Pentadectyle limbs are five - digited limbs.
- They have internal fertilization and lay eggs.
- They are homoiothermic (endothermic) animals Thus they have constant internal body temperature.

Example: Pegion, Eagle, ostrich

Class: **Mammalia**

- Body covered by hairs.
- Body skin consistes of glands (like subaceous gland) and sweat glands.
- They have endoskeleton.
- They have homoiothermic animals.
- Have two pairs of pentadectyl limbs.
- Breathe by lungs.
- Have external ears (in addition to inner and middle ears).
- They have internal fertiilization and internal development.
- They feed milk to their young.

Class mammalia has three groups: These are

i. Egg layer mammals
ii. Marsupial mammals
iii. Placental mammals

i. Egg layer mammals

- Primitive group.
- They lay eggs.
- They feed breast - milk to their young.

Example: Duckbilled platypus. (Australian ant - eater mammal)

ii. Marsupial mammals.

- They produce immatured young which complete the remaining development inside the pouch (Marsupium).
- They feed breast - milk from the memory gland

Example: kangaroo (Australian marsupial mammal).

iii. Placental mammals.

- Development of the young in the womb (uterus)
- Matured young born.
- Exchange of materials (Food, oxygen and wastes) between the mother and the foetus until the embryo complete it's development in the uterus (womb) by the placenta.
- Memmory gland of the breast secrete milk to nourish the young.
- They are called higher mammals.

Example: Human, cow, dog, bat, whale, lion, Elephant, rat, etc.

Renowned Taxonomists in Ethiopia

- Professor Sebsibe Demissew, is a botanist and plant taxonomist.
- He has published books and articles on the vegetation and plants of Ethiopia and Africa.
- Professor Ensermu kelbessa, professor Abebe Getahun, D.r Mesfin Tadesse, and professor Sileshi Nemomissa are few of the renowned Ethiopia taxonomists.

Conceptual Examples

Part II Give short Answer

44. Write the ecological and economic importance of insects.

Explanation

Ecological and economic importance of insects are:-

- Pollinators
- Food sources

- Removal of wastes and remains
- Crop pests
- Disease vectors
- Parasites and pathogens, etc.

45. What structural and functional features do bacteria and archaea share in common?

Explanation

- Both groups have cell wall
- No nucleus
- They are prokaryotics
- Both reproduced by binary fission.

46. What ecological roles do fungi play?

Explanation

- Fungi decompose materials, thus releasing nutrients that producers can take up and use.
- Fungi from mutually beneficial partnerships with plants and green algae.
- Some organisms use fungus as a sources of food.
- Some fungi are pathogens that invade the tissues of plants and animals.

47. What are the major groups of vertebrates?

Explanation

Fish, Amphibians, reptiles, birds and mammals

48. What are the criteria to group arthropods in to different classes?

Explanation

Arthropods are jointed and they are classified in to different classes based on:

- The number of their limbs
- The presence or absence of antennae.
- Parts of their body.

49. Describe the common features of all animals?

CS CamScanner

Explanation

All animals share the following common features:

- They are multicellular, eukaryotic & heterotrophs
- They have locomotory structure.
- They posses no chloroplast and cell well
- They can reproduce either sexually or asexually.
- They have nervous system

50. Explain the meaning of the following

Explanation

Hermaphrodites: an organism having both male and female sex organs.

Radially symmetric body: a body which can be divided in to many halves which are mirror image of one another.

Bilateral symmetric body: a body which is divided in to two halves that are mirror images of one another.

Ectoderm (Poikilotherms): Animals which have variable body temperature.

Endoderm (Homoiotherms): Animals that have constant body temperature which is not affected by external environment.

51. What is the meaning of arthropods and give example?

Explanation

Arthropods are an invertebrate animal that has an exoskeleton, a segmented body and jointed appendages.

Examples insects such as ants, bees, dragon flies, house flies, Arachinids such as spider and scorpion

52. What are the five main characterstics of all arthropods?

Explanation

They posses

- An exoskeleton
- Bilateral symmetry
- Jointed appendage
- Segmented bodies

- Specialized appendages

53. What is the shared characterstics of all vertebrates?

Explanation

The presence of dorsal, hollow nerve cord in all vertebrates post - anal tail and also gill slite at the embryo stage

54. What are vertebrates?

Explanation

Vertebrates are organisms which have an internal back bone also called vertebrae.

55. What are the four major characterics of vertebrates?

Explanation

- Have true vertebral column and internal skeleton.
- Are bilateral symmetrical
- Have complex differentiation of body tissues and organs.
- are triplobastic, coelomic and segmented

56. Mention the five main characterstics of animals?

Explanation

- Animals are: multicellular - eukaryotes
  - Heterotrophic
  - Reproduce sexually
  - Cells have no cell wall
  - They are motile (move)
  - They have sensory organs

Unite End Review Questions

Part I. Choose the correct Answer from the Given Alternatives.

51. A process by which on organism produces offspring is called

A) Reproduction C) Development

B) Homeostasis D) Inheritance

52. Bacteria that serve as decomposers are:

A) Photoautotrophs C) Photohetrotrophs
B) Chemoautotrophs D) Chemoheterotrophs

53. All fungi ________
A) are multi celled C) Form flagelated spore
B) are heterotrophs D) All of the above

54. Most fungi obtain nutrients from ______.
A) non - living organic matter C) Photosynthesis
B) living animals D) living plants

55. Fungal infections are most common in ______
A) Plants B) animals C) insects D) Dirds

56. Bacteria, archaea, and Eukarya are three ______.
A) Kingdom B) Classes C) Domain D) Families

57. Organisms require ___ and ___ to maintain themselves, grow, and reproduce.
A) DNA; energy C) Food; sunlight
B) Nutrients; energy D) DNA; cells.

58. Which of the following is least related to the others?
A) teff B) Maize C) Conifer D) Rose

59. Which classes of phylum Arthropoda posses no antenna?
A) Crustecea C) insecta
B) Arachinida D) Chilopoda

60. Which of the following animal has segmented body:-
A) Filaria B) Earth worm C) nematoda D) Mollusca

61. Phylas of kingdom animalia that contains all vertebrate animals is:-
A) Poritera B) Chordata C) Mollusca D) Arthropoda

62. An organism that posses both male and female sex organs is called:
A) Marsupial C) Sponges
B) Hermaphrodite D) Mammals

63. All of the following are placental mammal except one
A) Rabbit B) Elephants C) Kingaroo D) Dog

64. The features of external fertilization, scaly skinned, breath by gills belongs to class:
A) Reptiles B) Amphibians C) Pisces D) Aves

65. Having features of internal fertilization, lay eggs, scaly and horney body, lungs belongs to:
A) Reptiles B) Amphibians C) Pisces D) Aves

66. Which of the following is **miss - matched** between the organism and its group in which it belongs:
A) **Entamoeba histolitica** - Protozoa
B) **Candida albicans** - bacteria
C) **Plasmodium falcifarium** - protozoa
D) **Mycobacterium tuberculosis** - bacteria

67. Which of the following is vertebrate animals:
A) Earth worm C) Snail
B) Snake D) Star fish (splhy - skinned)

Part II. Say True if the statement is correct say False if the statement is in correct

68. Arachae have very different cell walls from bacterieca

69. Classification is the process of grouping living things

70. Ethiopia is a primary centre for *Eragrosis tef* and *Guizotia abyssinica*.

71. Gymnosperms are seed plants that do not make flowers or fruits.

72. Linnaus developed a two kingdom system of classification

73. Some autotrophic bacteria make their own food the way plants do and they are chemosynthetic.

74. Fungi can reproduce either by vegetative, asexual reproduction through spores formation and sexually.

75. Unicellular algae (Phytoplankton) are the bases of aquatic food chains and produce much of the oxygen in the earth's atmosphere.

76. Fungi, bacteria and some protista are called decomposers that play important role in the recycling of materials in the ecosystem.

77. Green plants are important They are sources of food, medicinal value, sources of oxygen, sources of fibres, ecological balance, etc.

Part III. Fill in the Blanks spaces

78. The group of organisms that can interbreeds and produce fertile offsprings are called ______

79. _____ is the study of classification and naming of organisms.
80. In a scientific name the first name is ____ and the second name is __
81. All prokaryotic organisms are included in the kingdom ____ .
82. The representative groups of kingdom monera are ____ and ____
83. _____ is the mutualistic association between fungus and roots of the plants.
84. The simplest green land plants are _____ .
85. The prominent leaf fern is _____ .
86. ______ are called naked seeded plants.
87. Seed bearing non - flowering plants are called ____
88. Seed bearing flowering plants in which seeds are enclosed in to the fruits are called _____ .
89. ____ are mammals that develop their immature young in their pouch.
90. The breathing organ of Pisces is called _____ .
91. ______ are vertebrates that spend parts of their lives in water and some parts of lives on land.
92. The two body parts of arachinida are ____ and _____ .
93. The most numerous groups of all invertebrates are ___ and from arthropoda are _____ .
94. Animals that do not have aback bone are called _________
95. Animals that have aback bone and an internal skeleton are called ____.
96. In body organization patten of an animals, if the left and right sides of body are mirror images of each other, it is called ______ .
97. In body organization pattern of an animals, if the body can be divided in to many equal parts, it is called _______ .

Answer key for

Unite End Review Questions.

Pare I. Multiple choice Items Answer key

51. A
52. D
53. D
54. A
55. A
56. C
57. B
58. C
59. B
60. B
61. B
62. B
63. C
64. C
65. A
66. B
67. B

Part II Answer key for True/False Items

68. True
69. True
70. True
71. True
72. True
73. False
74. True
75. True
76. True
77. True

Part III Answer key for fill in the Blanks Answer Species

78. Species
79. Taxonomy
80. Genus and species
81. Monera
82. Bacteria and cyanobacteric (blue green algae)
83. Micorrhizae
84. Bryophytes
85. Frond
86. Gymnospermea
87. Gymnospermea
88. Angiosperms
89. Marsupial
90. Gills
91. Amphibians
92. Cephalothorax and Abdomen.
93. Nematoda and Insects.
94. Invertebrates
95. Vertebrates
96. Bilateral symmetry
97. Radial symmetry

UNIT 3

Cells

3.1 What is Cell?

☑ Cell is the smallest and the basic unit of living things.

☑ All living things are composed of cells.

☑ Cells are the building - blocks of the organism.

☑ Some organisms are composed of one - cell (single cell) and are called unicellular organisms.

Example : Protozoa (Amoeba, paramecium, plasmodium, Trypanosoma, Giardia)

➥ Bacteria

➥ Yeast

☑ While other organisms like plant, animals, most algae and fungi are composed of many cells and are called multicellular organisms.

☑ Unicellular organisms are invisible with naked eyes but their are some exceptions like chicken egg cell and ostrich egg cell which can be seen with our naked eyes.

☑ The body of multicellular organisms is composed of many cells of specialized types which work cooperatively. Each activity of our body is the results of the cooperative work.

Example:- Brain cells for interpretation of messages to action .

➥ Nerve cells for gathering information

➥ Muscle cell for movement.

☑ Every activities we do are possible because of the process that occurs at the cellular level.

3.2 Cell Theory

The discovery of cell waits for the development of microscope.

Many scientists, natural philosophers and other scientists contributed a lot for the discovery of cells and for the developments of cell theory.

1. **Robert Hooke:** An English scientists, in 1665, was the first to observe cork dead cells.

   ➥ He did this after examining thin slices of plant material cork. by his own microscope.

   ➥ He saw tiny, regular compartments, which he called **cells.**

   ➥ The word cell came from Latin word, cellula meaning "Little rooms".

2. **Anton Van Leeuwenhoek:** Dutch microbiologist,

   ➥ The first to see moving living cells in a drops of water.

   ➥ In 1674 he observed protozoa for the first time and later he observed bacteria.

   ➥ He observed protoctistes and bacteria.

   ➥ He called the moving organisms "animalculus"

   ➥ His simple compound microscope with one lens magnification power was 300×.

   ➥ He is acknowledged as the father of microbiologists.

3. **Matthias Schleiden and Theodor Schwann**

☑ They coined the first clearly stated cell theory.

☑ In 1838, German botanist Matthias schleiden, after careful study on plant tissue, states that all plant tissues are composed of cells.

☑ In 1839, other German zoologist Theodor schwann state that "all animal tissues are composed of cells"

☑ There fore, the two German biologists established cells as the unit of structural, physiological, and organization in living things.

4. **Rudolf Virchow**, 1856, established the idea that cells arise from pre-

existing cells by cell division. Based on the above discoveries, the principle of cell theory is developed.

The Modern Cell Theory

Today, all this have been modified and extended in the increased knowledge of genetics and cell biology the modern cell theory stated.

The Cell Theory Stated that:

1. Living organisms are composed of one or more cells
2. Cells are the smallest unit of life
3. Cells arise only by the division of a pre - existing cells.

☑ Cells contain hereditary information, which is passed from cell to cell during cell division.

☑ All cell have basically the same chemical compositions.

☑ All energy flows occurs with in cells. so cells can be thought of as the smallest living structures.

Conceptual Example

1. Why do we study a bout cell?

Explanation

- We study cells because all activities of the organism taken place in the cell.
- The study helps to identify unicellular and multicellular organisms

2. Explain the major points of cell theory?

Explanation

- Organisms are composed of one or more cells.
- Cells are the basic structural and functional units of life.
- Cells arise only by cell division of previously existing cell.

3. Discuss the contribution of the following biologists and scientists in the developments of biological knowledge about the cell.

A. Robert Hooke
B. Anton van Leeuwenhoek
C. Theodor schwann
D. Matthias schieldn

E. Rudolf virchow

Robert Hooke: The first person to saw cork dead cell.

- Naming the shape hesaw in cork cellulae small rooms.

Anton van Leeuwenhoek : The first person to saw a moving living cells in a drop of water.

- He observed protoctistes and bacteria
- He was the father of microbiologist

Theodor Schwann and Matthas Schielden: They were the first clearly formulate the cell theory.

Radolf Virchow : Established the idea that cells arise from pre - existing cell by the cell division.

3.3 The Cell Structure and Function

Cells have different structures which have different functions. The organization of cells varies between different organisms. In multicellular organisms, cells have different shapes and different functions.

Example

Nerve cells have different in shape and function from muscle cells.

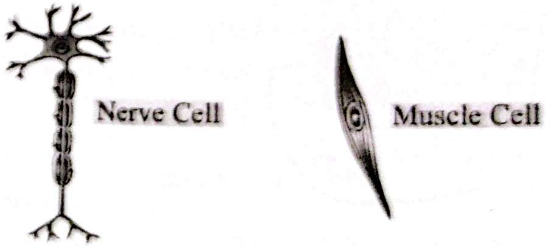


Fig 3.1 Nerve and Muscle cell

The similarity between plants and animals cell is the presence of common cell structure. The major structures these cells have in common are:

- Nucleus
- Cytoplasm
- Cell (plasma) membrane.

In addition to these structure of cells, there are many tiny structures in the cytoplasm called organelles. An organelle is a distinct structure with in a cytoplasm of a cell having a specific function. some of organelles have a membrane while others with out membrane.

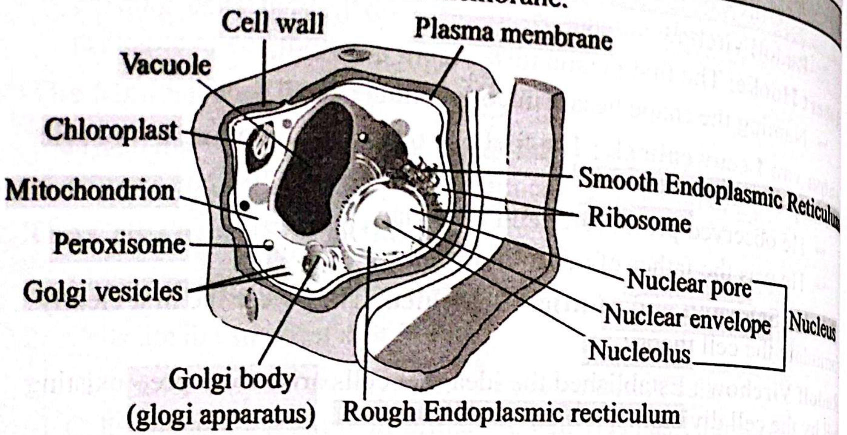

Cell wall
Plasma membrane
Vacuole
Chloroplast
Mitochondrion
Peroxisome
Golgi vesicles
Smooth Endoplasmic Reticulum
Ribosome
Nuclear pore
Nuclear envelope
Nucleolus
Nucleus
Golgi body
(glogi apparatus)
Rough Endoplasmic recticulum

Fig 3.2 Structure of Typical Plant Cell

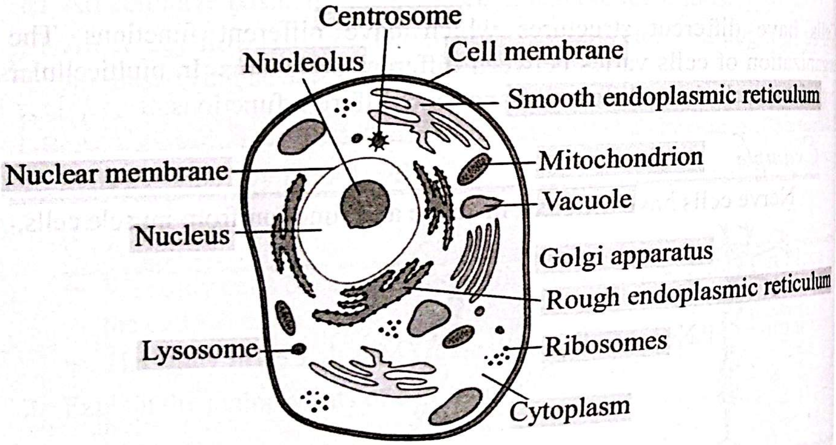

Centrosome
Nucleolus
Cell membrane
Smooth endoplasmic reticulum
Nuclear membrane
Mitochondrion
Vacuole
Nucleus
Golgi apparatus
Rough endoplasmic reticulum
Lysosome
Ribosomes
Cytoplasm

Fig 3.3 Structure of Animal Cell

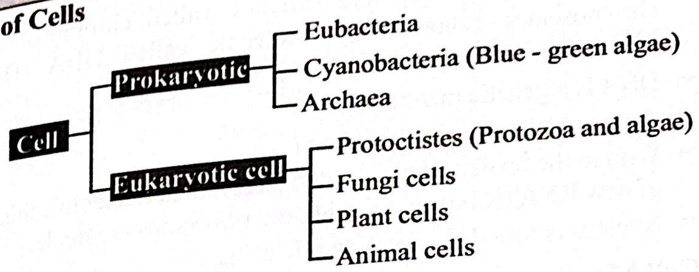
3.4 Types of Cells

What are prokaryotic and eukaryotic cell?

Based on the structure and complexity of their cells, organisms can be grouped in to two fundamental type. The two types of cells are:

- ➥ Prokaryotic cells
- ➥ Eukaryotic cells

Type of Cells


Cell
Prokaryotic
Eubacteria
Cyanobacteria (Blue - green algae)
Archaea
Eukaryotic cell
Protoctistes (Protozoa and algae)
Fungi cells
Plant cells
Animal cells

i. Prokaryotic Cells

☑ They were the first type of cells to be formed when life first evolved

☑ Prokaryotic cells are different from eukaryotes.

☑ The term prokaryotic cell is derived from the green words pro - which means before, and karyo - which means nucleus "before nucleus" reflecting the earlier evolution of prokaryotes, the earlier form of life.

☑ Prokarytic cells are the smallest cells known. It's length in diameter is 1μm to 10μm in size. They are smaller and simpler than eukaryotic cells.

☑ Nucleus is absent in prokaryotic cells and they have no membrane bound organelle

☑ They are smaller than eukaryotic cells.

☑ Prokaryotic cells are unicellular.

☑ They contain cell wall made up of peptidoglycan. which acts as extra layer of protection.

Example: Bacteria

Eukaryotic Cell Structures and their Functions

☑ Eukaryotis cells have three major parts. These are nucleus, cytoplasm and cell membrane.

☑ All eukaryotic cells have these structures in common.

1. Nucleus:

- ➥ Nucleus is the largest organelle of the cell.
- ➥ It is surrounded by a double membrane called nuclear membrane.
- ➥ It directs and controls all cellular activities

- It determines what the cell will be.
- It contains a thread - like structure called chromosomes. The chromosomes contain large molecule called DNA (Deoxy - ribonucleic acid).
- DNA is a genetic material
- The nucleus control cell division.
- With in the nucleus their is a dark area called nucleolus, this is site of new RNA (Ribonucleic acid) and ribosomes are made.
- Nucleus is found in all eukaryotic cells.

2. Cell Membrane:

- It is outer covering of a cell.
- It separates the cell's interior from it's surrounding environment.
- Cell membrane is very thin structure made up of proteins and a lipid called phospholipid.
- Cell membrane controls the movements of substances what enters in to and leaves a cell out.
- It is called selectively permeable or semi - permeable membrane structure.
- It allows materials only having smaller molecular weights (very small particles) to get in to or out from the cell
- It allows the entry and exit of organic molecules, inorganic molecules (Ions, water, oxygen) in to and out from the cell. Waste products, such as carbon dioxide, urea, and also mineral salts are leave the cell by passing througn the cell membrane.
- All cells contain cell membrane or plasma membrane commonly.

3. Cytoplasm:

- Cytoplasm is a jelly - like fluid that fills the enternal structure of the cell.
- It is a centre for chemical reaction of a cell.
- It contains many organelles.
- The major organelles in the cytoplasm of eukaryotic cells are nucleus, mitochondria, chloroplasts, Golgi apperatus, lysosomes, Ribosomes, endoplasmic reticulum, centrioles, etc
- The word organelles is derived from a Latin word meaning " Little organs"

- Protoplasm is the living portion of cell. It is composed of nucleus and cytoplasmic structure. and helps cell maintain its shape and prevent dehydration.
- Example of prokaryotic organisms are bacteria, cyano bacteria or blue - green algae and Archaea.

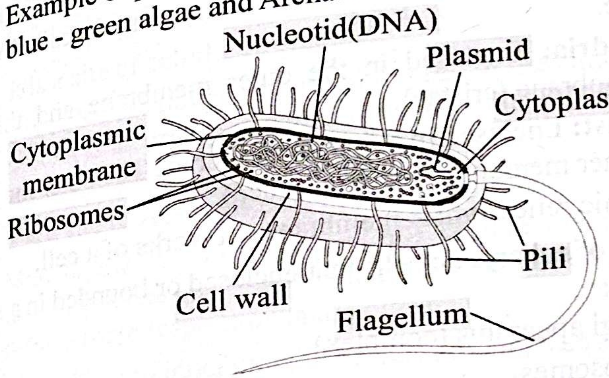


Fig 3.4 Bacteria

☑ The following structures have common to all bacteria:
- Cell wall
- Cell membrane
- Cytoplasm
- Ribosomes
- DNA

ii. Eukaryotic Cells

What are eukaryotic cells?

☑ Eukaryotic cells have true nucleus with membrane bound organelles

☑ Each organelle in eukaryotic cells have a distinctive structure and function

☑ Eukaryotic cells composed of unicellular such as protoctistes (protozoa and some algae) and multicellular (plants, animals and some fungi and some algae).

☑ Eukaryotic cells are ten times larger than prokaryotes.

☑ It's size in diameter is 10μm to 100μm in length. Even some are greater such as chicken egg cell and ostrich egg cells.

☑ Ostrich egg cell is the largest cells known. It is more than 5cm in diameter.

☑ The term Eukaryotes is derived from the Greece, eu - which means true, and karyot which means nucleus.

☑ Eukarytic cell is a cell with true nucleus.

A. Organelles of eukaryotic cells that enclosed or bounded in a double membrane are:

- **Nucleus:** The double membrane of the nucleus is called nuclear membrane.
- **Mitochondria:** Enclosed in the outer membrane and the inner folded membrane (cristae).
- **Chloroplast:** Enclosed in a double membrane The outer membrane and the inner membrane (but not folded).
- Endoplasmic reticulum: A membrane net works of a cell.

B. An organelles of eukaryotic cells that enclosed or bounded in a single membrane are:

- Golgi apparatus (complex).
- Lysosomes
- Centrioles
- Vacuoles

C. An organelles with no membrane bound structure are:

- Ribosomes
- Peroxisomes.

Comparison of Prokaryotic and eukarytic cell

Structure	**Prokarytic cells**	**Eukaryotic Cells**
Organelles	No membrane bound organelles	Have membrane bound organelles
Nucleus	Absent	Present
Cell Wall	Always present made of peptidoglycan	Absent
Chromosome	DNA present but not associated with protein coat called histone. ☑ Circular plasmid may be present.	☑ Present. DNA arranged in along strands, associated with protein coat called (Histone).
Mitochondria	Absent	Present
Chloroplast	Absent	Present in plants and absent in animals
Ribosomes	Present but smaller than euaryotes, 70's	Present and larger than prokaryotes, 80's

Mitochondria:

- It is a site of cellular respiration.
- It is called the power - house of the cell or the battery of the cell. Be cause it is an organelle which is responsible for releasing energy for cellular activities.
- It is a site of ATP synthesis from food.
- Mitochodria is surrounded with a double membrane. The outer membrane. and the inner folded membrane called cristae, It is where most aerobic respiration taken place.
- The folding of inner membrane helps to increase the surface area for respiratory reactions.
- Mitochondria is found in all eukaryotic cells but it is number increased in the active cells such as kidney cells, liver cells, muscle cells, brain cells, etc. to fulfil the energy demand of the cell.

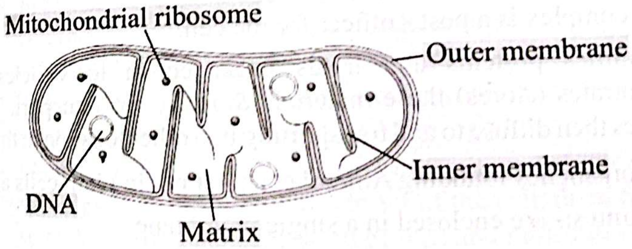


Fig 3.5 Mitochondria

Endoplasmic Reticulum:

- It is the membrane net - works of the cell.
- It is the net works internal membrane extending through the cytoplasm.
- It connects two nucleus with the cell membrane there are two forms of endoplasmic reticulum in a cell. These are:
- Rough endoplasmic reticulum: have ribosomes on its membrane surface and is involved in protein transport that is synthesized by

the ribosomes.

Smooth Endoplasmic Reticulum:

- Have no ribosomes on it is smooth surface. So that it is called smooth surface.
- It is concerned with lipid synthesis, carbohydrate metabolism and detoxification.
- Ribosomes are small cellular structures that are found in large numbers in all cells.

Ribosomes: They are found attached to rough endoplasmic reticulum but some are free in the cytoplasm.

- They are composed of RNA and protein
- Ribosome are responsible for protein synthesis for the cell.
- Ribosomes are found in both prokaryotic and eukaryotic cells;

Golgi Complex (Golgi body /Golgi apparatus)

- Are sacks of flattened membrane.
- The organelle was first described by an Italian scientists Camilo Golgi (in 1898).
- Golgi complex is a post - officer for the cell.
- It modifies proteins and lipids packaged in to vesicles and concentrates (stores) these materials & ready for transport. These vesicles then diffuse to and transporting it to other location in the cell.

Some of the organelles founding Animal cells but not in plant cells are:

- **Lysosomes:-** are enclosed in a single membrane
- It is a membranous sacks that produce digestive enzymes and disintegrates cellular wastes and debris, damaged and worn out cells.
- Thus, they are called self - destructing organelles. " It also some times called" self - suicide sack"

Centrioles: are an organelle in animal cells only in cell division.

- It is located near to the nucleus
- It contains spindle fibres during mitotic type of cell division.

Some organelles and Some of the structures of a cell found in plant cells but not in animal cells.

Cell wall:- is found on the outer layers of plant cell.

- It is made up of complex polysaccharides carbohydrates called cellulose.
- It provides support, shape, protection for the cell.
- Cell wall gives regular shape for the plant cell (rectangular or hexagonal cell).
- The cell wall is a completely or fully permeable of materials in to or out from the cell.

Central Vacuole: is a fluid filled sack which contains a fluid called cell sap.

- They are used to transport and store ingeted materials, wastes and water.
- They are also used to maintain turgidity of cell.
- It is permanent large vacuole in plants.
- Vacuoles are organelles that consistes of a single membrane with fluid inside.
- In animal cells vacuoles are small and temporary.
- In animal cells food vacuoles in some animals to digest food and contractile vacuole in some unicellular organisms which function is to expel water. Example Amoeba, paramecium.
- The food vacuole in unicellular eukaryotes such as amoeba ingest food particles by the process called phogocytosis.
- Many unicellular protistes living in fresh water have contractile vacuoles to pump excess water out of the cell, there by keeping a suitable internal concentration of ions and molecules of the cell.
- Chloroplast: They are a double membrane bounded organelles that occurs in the cell of green plants and algac, Mostly in the cell of the leaves.
- Chloroplast contain chlorophyll, which is a green - pigment that can trap the sun light energy for the synthesis of carbohydrate by photosynthesis.
- It is the site for photosynthesis.

Plastid: Consistes of three structures. These are chloroplast, chromoplast and leukoplast.

- Chromoplast: gives colour to flower and fruits

- Chloroplast: a pigment to capture sun - light
- Leukoplast: Storage site or starch.

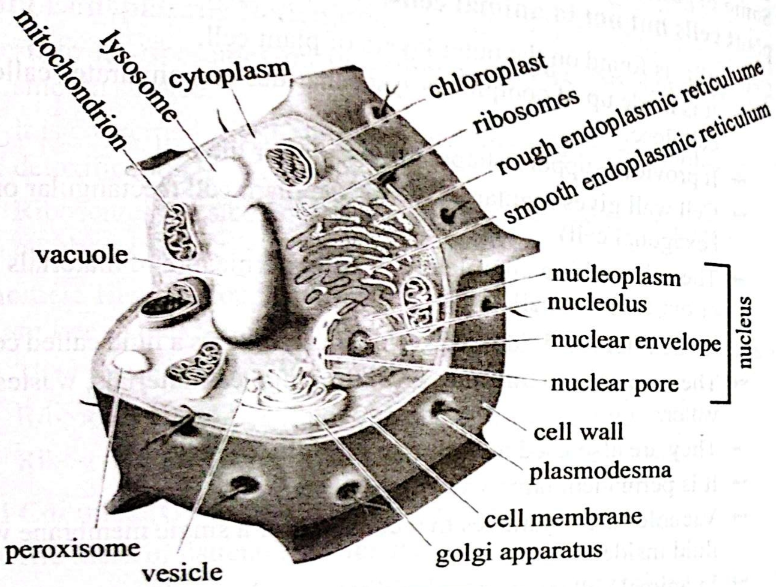

mitochondrion
lysosome
cytoplasm
chloroplast
ribosomes
rough endoplasmic reticulume
smooth endoplasmic reticulum
vacuole
nucleoplasm
nucleolus
nuclear envelope
nuclear pore
nucleus
cell wall
plasmodesma
cell membrane
golgi apparatus
peroxisome
vesicle

Fig 3 . 6 Generalized plant cell

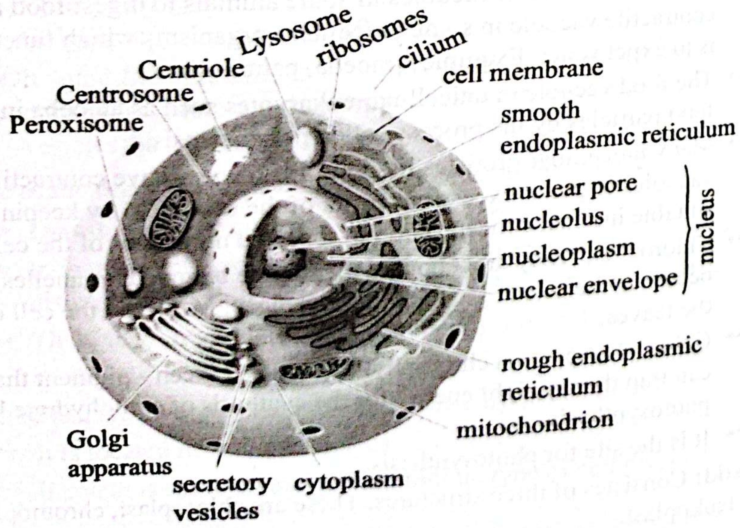

Lysosome
ribosomes
cilium
Centriole
cell membrane
Centrosome
Peroxisome
smooth endoplasmic reticulum
nuclear pore
nucleolus
nucleoplasm
nuclear envelope
nucleus
rough endoplasmic reticulum
mitochondrion
Golgi apparatus
secretory vesicles
cytoplasm

Fig 3 . 7 Generalized Animal Cell

Conceptual Example

4. Explain the structure of a cell that are involved ir the synthesis and transportation proteins?

Explanation

- Ribosomes are involved in protein systhesis.
- Rough endoplasmic reticulum has ribosomes on its surfaces and its used to transport protein inside a cell.

5. Mention the constituent of plasma membrane.

Explanation

- Plasma membrane (cell membrane) is made up of protein and lipid bilayer called (Phospholipid and protein). bilayers of phospholipid.

6. Explain why do cells of the body like muscle cells, kidney cells and liver cells and liver cells posses large number of mitochondria.

Explanation

Since mitochondoria synthesize ATP to carry out the cellular activities by providing energy, and activities cells such as muscle cells, brain cell demands more energy to carry out their activities. Thus, they require large number of mitochndria than other cells of the body.

7. Mention the structure of cells common to all eukaryoticliving cells?

Explanation

Nucleus, cytoplasm and cell membrane are structures of a cell common to all eukaryotic cells.

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Summary of the Structure and Function of Parts of Cells.

Table 3 . 1

Structure	Functions
Cell wall	☑ Support, protect, and give cell shape. ☑ It allows free movement of molecules.
Nucleus	☑ Controls cell activities ☑ Directing cell activities ☑ Genetic information centre.
Cell membrane	☑ Envelop the cell content ☑ Semi - permeable (or selectively permeable) by controlling the movent of molecules in & out from the cell.
Mitochondria	☑ Power house of the cell. ☑ Release energy for the cell ☑ The center of ATP synthesis
Chloroplast	☑ Contain chlorophyll, a green pigment, that trap sun light energy. ☑ Convert light energy to chemical energy by photosynthesis.
Cytoplasm	☑ Contain different organelles ☑ Different chemical rxn takes place ☑ Contain stored food.
Ribosomes	☑ An organelle involved in protein synthesis
Vacuole	☑ filled with fluid called cell - sap. ☑ Large permanent vacuoles in plant cell ☑ keep the cell turgid in plant cell
Golgi complex	☑ Storing, packaging and modifying of proteins and lipid. ☑ It is a post officer of a cell.
Lysosomes	☑ Contain hydrolyse enzyme that break cellular wasters and debris, damaged organelle. ☑ It is a self suicide sac.
Centrioles	☑ Involved in cell division in animals cell
Plastid	Contain chloroplast, chromoplast and leucoplasts in plant cell.

Supplementary Exercise

Part I. Match the following organelles in "B" with their functions under column "A"

A	B
8. Power house of the cell	A. Golgi complex
9. Carry out photosynthesis	B. Nucleus
10. Control and directing cellular activities	C. Lysosomes
11. Modify, packaged protein and lipid and ready for transport.	D. Chloroplase
12. Disintegrate cellular wastes and debris	E. Mitochonderia
13. Ribosomes	F. Synthesize protein

Part II Choose the Best Answer for the Following Question

14. Which of the following structures is found in animal cells, but not in plant cells?
    - A. Cell surface membrane
    - B. Centriole
    - C. Chloroplast
    - D. Golgi body
15. Fill in the following table by giving the function of the organelles.

Table 3 . 2

Organelles	Function of the organelles
Centrioles	A
Smooth Endoplasmic Reticulum	B
Rough E. Reticulum	C
Mitochondria	D
Cell wall	E

16. Chromosomes that contain the genetic information of an organism are found in the:-
    - A. Cell wall
    - B. Nucleus
    - C. Chloroplast
    - D. Cell membrane
17. Energy releasing organelle of a cell is:

CS CamScanner

A. Ribosome
B. lysosome
C. Mitochondria
D. Centrioles

18. Which of the following includes all the rest:

A. Nucleus
B. Cytoplasm
C. Nucleolus
D. Protoplasm

19. The structure that keeps plant cells turgid is:-

A. Vacuole B. Nuclueus C. Ribosome D. Cell wall

20. A cellular structure in animals that assists a process of cell division is;-

A. lysosomes
B. Centrioles
C. Nucleus
D. Vacuole

21. All are the major structure of a cell except one which one is it?

A. Cell membrane
B. Nucleus
C. Cell wall
D. Cytoplasm.

22. The movement of substances in and out from the cell is controlled by:

A. Endoplasmic reticulum
B. Cell membrane
C. Golgi complex
D. Cell wall

23. The self - suicide sack of a cell that is found only in animal cell is: ___

A. Mitochondria
B. lysosomes
C. centrioles
D. Vacuole

24. Cells that are adapted to carry out a particular body function are:

A. Undifferentiated cells
B. Embryonic stem cells
C. Specialized cells
D. Unspecialised cells

25. One of the following cell lack nucleus and membrane bound compartment:-

A. Fungi B. Protozoa C. Eubacteria D. Algae

Part III. Fill in the Blank spaces with Appropriate Words.

26. A structure that supports and strengthen plant cell is ______

27. A structure that breakdown a captured bacterium and damaged organelles in the cell is ______

28. A sack - like structure used to transport protein is ______

29. A type of cell that lack nucleus, membrane bound organelles, mitochondria & chloroplast is called ______

30. A structure of cell that is found only on animal cells are ______

Illustrative Example

31. Compare and contrast cell wall and cell membrane.

Table 3 . 3

Cell Wall	**Cell membrane**
Found in plant cell, bacteria, algae and fungi	Found in all eukaryotic cell
Made up of cellulose (plant) peptidogly cane (bacteria), chitin (fungi)	Made up of lipid and protein (lipoprotein)
Fully permeable	Semi - permeable (Selectively permeable)
It is rigid	It is very fine and not rigid as cell wall

32. What are the distinguishing characters of plants and animals.

Explanation

The presence of chloroplast, chlorophyll, cell wall and the presence of large permanent vacuoles in plant cells and absent in animal cells.

3.5 Animal and Plant Cells

Animals and plant cells have certain structures in common like:

- ☒ Cell membrane
- ☒ Nucleus
- ☒ Cytoplasm
- ☒ Organelles such as:
    - Mitochondria
    - Golgi complex
    - Ribosomes
    - Endoplasmic reticulum

Table 3 . 4 Comparison of Plant and Animal Cells

PLANT CELL	ANIMAL CELL
☑ They are large cell size	☑ They are relatively small in size
☑ Have regular shape	☑ Have irregular shape
☑ They have cellulose cell wall	☑ They have no cell wall
☑ They have organelles such as plastid, & leukoplast	☑ They have organelles such as centrioles and lysosomes
☑ They have large Permanet central vacuole	☑ The nucleus is central
	☑ The vacuole is small and temporary

The plant vacuole is surrounded by a membrane and contains fluid. The fluid in the vacuole is solution of pigments, enzymes, sugars and other organic compounds and waste products, mineral salts and oxygen and carbondioxide.

Conceptual Example

33. List the structures in plant cells that animal cells lack?

Explanation

Cell wall, chloroplast, chlorophyll, large permanent central vacuole, large sized cell, regular shape cell (hexagonal or rectangular shape).

34. List the structures in animals cells that plant cell lack?

Explanation

Lysosomes and centrioles with small - sized cell and irregular shaped.

35. List the structural features that prokaryotic and eukaryotic cells have in common.

Explanation

Both cell types contain:- Cell membrane that enclose the cell.

- ➥ Cytoplasm
- ➥ Cell wall (Prokarytic, plants, fungi & algae).
- ➥ Ribosomes
- ➥ DNA (genetic material).

3.6 The Cell and It's Environment

The Cell Membrane:

A cell interacts with its environment through the cell membrane. This is due to reason that a cell requires useful nutrients and oxygen and also removes waste materials such as carbondioxide and urea.

The cell membrane is a selectively permeable membrane structure that controls what enters and leaves the cells.

Exchange of materials between the cell and its environment takes place in the following major ways:

- ➥ Passive transport
- ➥ Active transport

3.6.1 Passive Transport

What is passive transport?

Passive transport is the process of transporting substances across the plasma membrane with out the expenditure of extra energy from the cell.

☑ The movements of the cell rely on:

☑ The kinetic energy of the particles of the substance it self.

☑ and on the concentration of gradients.

☑ Passive transport is the movements of substance from high concentrated region to an area of low concentrated region with out the need for impute of Energy.

Example of passive transports are:

- ➥ Simple diffusion
- ➥ Facilitated diffusion
- ➥ Osmosis

How do substances cross the plasma membrane?

To pass through the plasma membrane by simple diffusion particles must be

- ➥ Small
- ➥ Lipid soluble
- ➥ Non - charged

i. Simple Diffusion

What is simple diffusion?

It is the net movement of molecules or ions from a region of high concentration to a region of low concentration gradient.

Diffusion is a passive transport of molecules;

The molecules need only spread themselves, or diffuse, across the membrane.

The particles of fluid and gases are free to move around by diffusion. oxygen is important for respiration and get in to the cell by diffusion.

Particles move across the membrane until the concentrated gradients are in equilibrium.

Factors Affecting the Rate of Diffusion:

A. **Concentration gradients:** The higher the difference in the concentration of gradient results in the faster rate of diffusion from higher concentration to the lower.

B. **Temperature:** Increase in temperature causes an increase in the kinetic energy that ions and molecules possess enabling them to move faster.

C. **Thickness of the membrane:** particles must cross some kind of barrier, a shorter distance results in faster diffusion.

➥ The farther the distance that a substance must travel, the slower the diffusion rate is.

D. **Mass of the molecule:** Heavier molecules move more slowly; while lighter molecules diffuse faster.

E. **Surface Area:** The greater the surface area the faster the total diffusion is cells that are involved in rapid absorption like tiny projections in the intestinal wall called micro villi.

ii. Facilitated Diffusion

It is the same process as diffusion; in that it depends on the concentration gradiet to allow particles to cross the membrane. However, it differs in that the perticles must be helped to diffuse a cross the membrane by carrier protein or a channel protein with an ion pore.

iii. Osmosis

What is osmosis?

☑ Osmosis is special case of diffusion.

☑ Osmosis is the net movement of water from a region of high concentration of water molecules (lower solute concentration) to a region of lower concentration of water molecules (higher solutes concentration) across the semi - permeable membrane.

☑ The movements of water is affected by the concentration of solutes dissolved in the water.

☑ Water moves from areas of more water to areas where less water is called osmosis

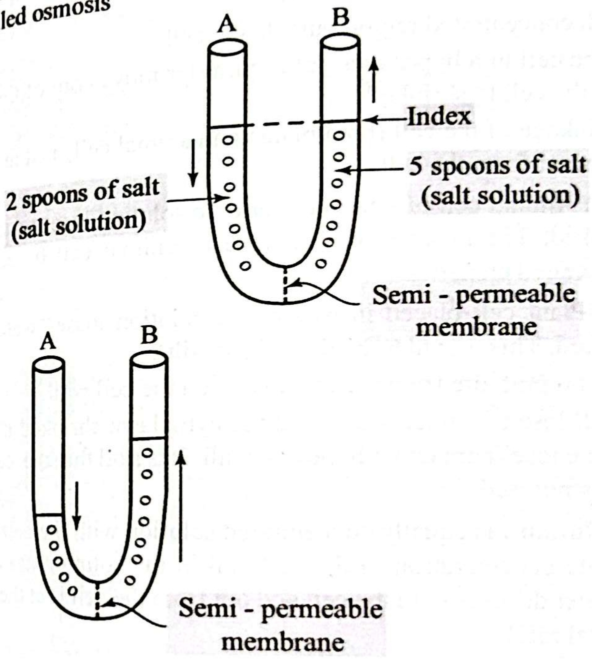


Fig 3.8 Osmosis

☑ Arm "B" has more salt solution than arm "A"

☑ As the arrow indicates, more water molecules move from area "A" to area "B". so the net movement of water is from arm "A" to arm "B" raising the level of the water in arm "B" and lowering in "A".

☑ The movements of water in to and out of the cell depends on the concentration of gradients.

☑ Osmosis in living cells can be shown in different concentration of solutes: These are:

- Hypertonic solution
- Hypotonic solution
- Isotonic solution

A. Hypertonic solution: a solution with high concentration of solutes and low a mounts of water.

- It is strong solution out side the cell.
- It is high concentrated region outside the cell.
- When the cell in a hypertonic solution,water moves out of the cell, causing the cell to shrinked
- The shrinkage of the cell (both plants and animal cell) is due to the loss of water from the cell.

In animal cell: Animal cell placed in hypertonic solution loses water and becomes shrinked. The process of shrinkage of animal cell because of losing water is celled crenation.

In plant cell: Plant cell placed in hypertonic solution losses water and becomes shrinked. This is said to be flaccid (or wilt).

- There is no pressure from the cytoplasm on the cell wall.
- If the cell lose too much water and the cytoplasm shrinked the cell membrane loses contact with the cell wall. It is said that the cell has been plasmolysed.

B. Isotonic Solution : is equally concentrated solution with the cell.

- The solute concentration in the cell and in the solution are equal. Thus, water diffuses in to the cell and out from the cell is at the same rate (equal rate).
- No change in size of the cell.

  Example. Blood cells are in isotonic solution.

C. Hypotonic Solution: where the dissolved solutes are less concentrated (weak solution) than the cell has or pure water/distilled waterl.

- Thus, the cell gain water by osmosis and swell up.

Hypotonic solution In animal cell: the cell gain water and swell up.

- The water pressure will eventually burst the weak plasma membrane. This is called haemolysis. The cell become splitted up (burst) be cause animal cell contain no cell wall.

Hypotonic solution In plant cell: the cell gain water and swell up. How ever, because of the presence of cell wall in plant cell, the cell can not

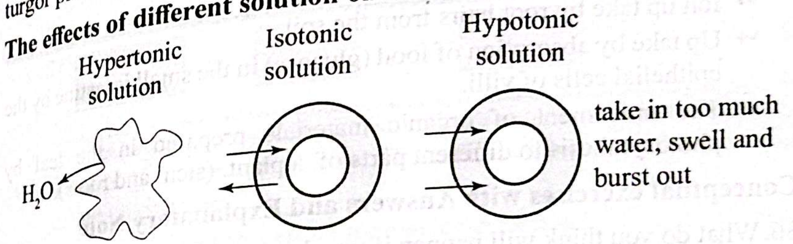
---

become much larger. Plant cells in this condition are turgid (rigid).

- Turgidity is important in supporting young plants stem.
- The turgid cells will press against each other and this pressure will keep the plant up right.

Turgor pressure: The swelling up of the cell creates a pressure that pushes the cell wall out wards. This pressure exerted on the cell wall is called turgor pressure.

The effects of different solution on animal cells (red blood cells)



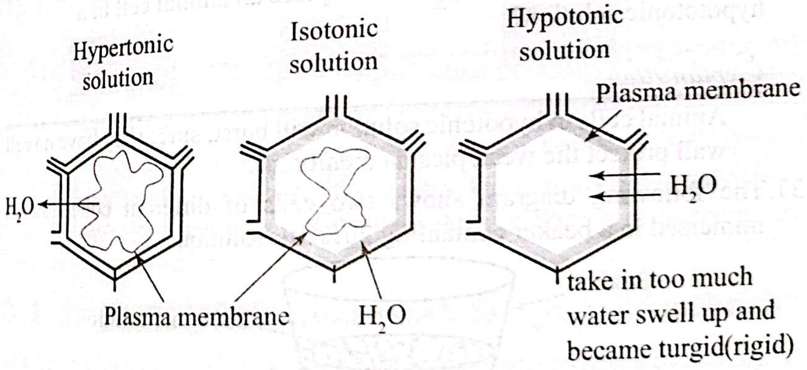


Fig 3.9 Too much water swell up and became turgid (rigid)

3.6.2 Active Transport

What is active transport?

☑ Active transport is the movement of molecules from an active regions where they're less concentration to area where they're more concentrated using energy.

☑ Active transport is the movements of particles through a cell membrane from a region of lower concentration to higher concentration against a concentration gradient.

☑ The movements of particles against a concentration gradient requi the expenditure of energy.

☑ The substance is absorbed against the concentration gradient.

☑ Cells some times pump substance out, even though their is alread larger concentration outside.

Example of active transport

- Ion up take by root hairs from the soil.
- Up take by absorption of food (glucose) in the small intestine by th epithelial cells of villi.
- The movement of organic materials prepared in the leaf b photosynthesis to different parts of a plant. (stem and roots).

Conceptual exercises with Answers and Explanatory Note

36. What do you think will happen if we place an animal cell in a hypototonic solution?

Explanation

Animal cells in hypotonic solution will burst, since they have no cel wall protect the weak plasma membrane.

37. The following diagram shows two cells of different concentratio immersed in a beaker containing 20% salt solution.

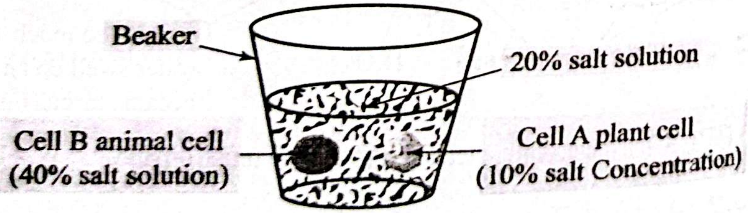


Fig 3.10 Osmosis in plants and animal cells

Explanation

Cell A (plant cell) contain more water than its environment. There fore, it losses water to its environment by osmosis. Thus, cel

A(plant cell):- Loss water byosmosis
- Shrinked
- Decreases in mas

Cell B (Animal cell) contain less water then its environment

☑ There fore, it gains water from its environment by osmosis

☑ Thus, **cell "B" (animal cell):** gains water by osmosis
- Increases in mass, this
- Increase turgor pressure
- The pressure burst the cell and the cell dead.

38. If a plant cell is put in a concentrated salt solution, what happen to the cell?

Explanation

If plant cell is placed in concentrated salt solution (strong solution), it losses its water by osmosis, Thus, the cell become shrinked and called plasmolysed.

39. Mention two factors that affect the rate of diffusion?

Explanation

Temperature: Diffusion increases when the temperature increases.
- The rate of diffusion can be affected by temperature.
- The higher the temperature, the faster the rate of diffusion.

Concentration gradient: The higher the concentration difference between two areas, the faster the rate of diffusion in to the lower concentrated area.

3.7 Level of Biological Organization

Life forms a hierarchy of organization from atoms to complex multicellular organisms.

A. The Cellular Level of Organization

Atoms → molecules → organelles → cells → Tissues → organ → organ system (system) → organism

At the cellular level, atoms are the fundamental elements of matter.

Molecules: atoms are joined by chemical bond in to clusters called molecules.

Organelles: Complex biological molecules are assembled in to tiny structure of cells called organelles.

Cells: The fundamental units of life with in a membrane bound units calle cells.

☑ Cells carry out all process of life

☑ Cells when they have finished dividing and growing become specialize

☑ When cells specialized, they do one particular Job, distinct shape and structure.

Example of specialized cells:

- ➥ Nerve cells (neurons).
- ➥ Egg cell and sperm cell.
- ➥ Epithelial cells
- ➥ Muscle cells.

☑ The shape of cells are very much related to their function. Nerve cell is thin and long which is suited to transport nerve message. Muscle cell is elongated muscle fibres adapted for body movement.

Tissues: A group of similar cells that work together to carry out a special job is called tissue

☑ In animals: bone tissue, muscle tissue, epithelium tissue, blood tissue, a nerve tissue, etc.

☑ In plants :- xylem tissue, phleom tissue, etc.

Organs: a group of tissues that work together to do a job is called organ.

Example: Mouth, stomach, liver, kidney, intestine, etc.

System (organ system):- A group of organs that work together to do a certain job is an organ system.

- ➥ The organs that work together to digest food are called digestive system.
- ➥ The organs that work together for blood circulation is called circulatory system.

Organism: All organ systems working together make up an organism

- ➥ An organism is a living thing

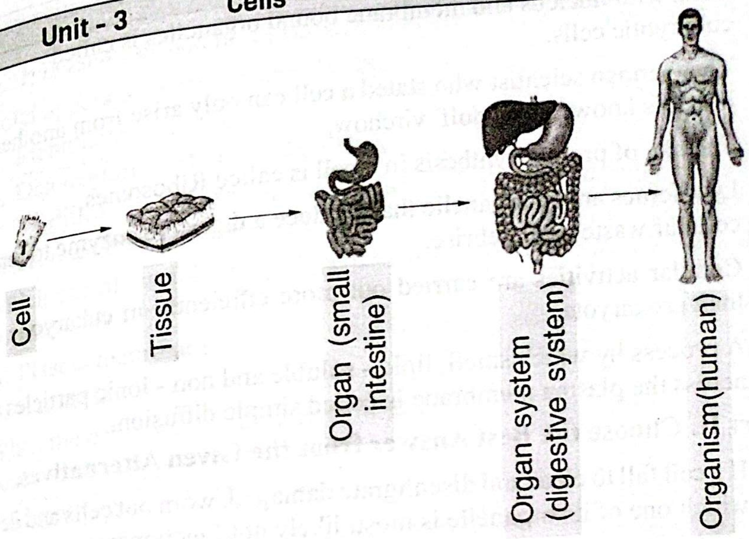


Fig 3.11 Level of organization in Animals

B. Ecological Level of Organization

The level of organization extends beyond the individual organismic level.

Organism → Pupulation → community → Ecosystem → Biomes → Biosphere (or Ecosphere).

The relationship is based on an increasing level of their complexity.

It shows the ecological level of organization at the organismic level.

End of Unit Review exercises

Part I. Say True of the statement is correct and false if the statement is incorrect.

1. The process by which net water moves a cross the plasma membrane requires the expenditure of energy.
2. The organelle in which proteins are modified and packaged is known as ribosomes.
3. The process by which particles moves across the plasma membrane against the concentration gradients is called active transport.
4. The site of photosynthesis in a plants cell is called chloroplast.

5. Cells with nucleus and membrane bound organelles is called eukaryotic cells.

6. The German scientist who stated a cell can only arise from another cell like it is known as Rudolf virchow.

7. The site of protein synthesis in a cell is called Ribosomes.

8. Lysosomes are an organelle that produce a digestive enzyme to remove cellular wastes and debrise.

9. Cellular activities are carried out more efficiently in eukaryotic cells tnan prokaryotes.

10. A process by which small, lipid - soluble and non - ionic particles across the plasma membrane is celled simple diffusion.

Part II. Choose the Best Answer from the Given Alternatives.

11. If a cell fall to clear and disentigrate damaged, worn out cells and debris, which one of its organelle is most. likely not functioning:-

A. Nucleus
B. Mitochonderia
C. Lysosomes
D. Golgi apparatus

12. Which of the following will happen if a potato cylinder cells kept in a solution stronger than its protoplasm

A. The cell wall become rigid
B. The cell become turgid
C. The protoplasm will get plasmolysed
D. The central vacuole will expanded and firmly attached the membrane on the cell wall.

13. In which of the following solution does an animal cell under go haemolysis:-

A. In isotonic solution
B. In hypotonic solution
C. In hypertonic solution
D. In both hypotonic & hypertonic

14. If an onion epidermal cell (plant cell) containing dissolved solutes in it is 0.01%. What happen to the cell if it is placed in a solution containing 1.0% salt solution.

A. It loses water and becomes haemolysed
B. It gains ware and becomes creanated
C. It gains water, swells up and becomes turgid

D. It loses water and becomes plasmolysed.

15. Golgi apparatus is responsible for the:

A. Manufacture of lipid
B. Disintegration of unwanted debris
C. Modification and packaging of protein & lipid molecules
D. Produce energy for the cell.

16. Which one of the following structures is found in animal cells, but not in plant cells?

A. Plasma membrane
B. Centrioles
C. Chloroplast
D. Golgi body

17. When the cell's surrounding environment contains a relatively high concentration of water, we call it:-

A. Hypotonic B. Hypertonic C. Isotonic D. Osmotic

18. Which one of the following structures is found in plant cells, but not in animal cells?

A. Cell membrane
B. Mitochondria
C. Cell wall
D. Nucleus

19. In which direction does the transport of water occurs when a cell containing 1% solute is placed in sea water that contains 10% salt solution?

A. from the cell to sea water
B. from sea water to the cell

20. If you look in to a microscope and view an unknown cell. what structure might you see that would tell you that the cell is eukaryotes?

A. DNA
B. nucleoid region
C. a plasma membrane
D. membrane enclosed structures.

Part III. Fill in the Blanks Spaces with Appropriate words

21. A structure that supports and strengthen plant cell is ______

22. A structure that break down a captured bacterium and damaged organelle in the cell is ____.

23. A sack - like structure used to transport protein is ______.

24. A structure made up of a group of tissues, working together to perform a specific function is _____.

25. When the osmotic pressure is the same on both side of a semi -

permeable membrane, each solution is said to be ______.

Part IV Fill in the blanks spaces of the table represented by letter with appropriate level of organization

Table 3 . 5

Cell	Tissue	Organ	System
Red blood cells	Cardiac muscle tissue	Heart	A
Egg/ sperm cells	Epithelium tissue of male and female reproductive organ	B	Reproductive system
Mucous cell	Epithelium digestive tissue	C	Digestive system
xylem and Phleom cell	xylem and phleom Tissue	D	E
Nerve cell	Nerve tissue	F	Nervous system

Part V Fill in the blanks spaces of the table by saying yes or No

Table 3 . 6

Movements of substance crossing the plasma membrane	Diffusion	Osmosis	Active Transport
Oxygen and carbon dioxide	Yes	Yes	No
Water	Yes	Yes	C
Ions like potasium			Yes
Energy is required			Yes
Mineral ions taken from the soil by root hairs			Yes
Absorption of food in the gut by micro villi			Yes
Synthesized organic molecules from the leaf			Yes

Answer Key

Supplementary Exercise

Part I. Answer key for matching item

8. E 9. D 10. B 11. A 12. C 13. F

Part II. Answer key for Multiple choice item

14. B

15. A. Involves in cell division

B. lipid synthesis and carbohydrate metabolism

C. Contain ribosomes for protein synthesis

D. Synthesis ATP (aerobic respiration take place)

E. Provide protection, support and give shapes for plant cell

16. B 18. D 20. B 22. B 24. C

17. C 19. A 21. C 23. B 25. C

Part III. Answer key for blanks spaces item

26. Cell wall

27. lysosme

28. Visicles

29. Prokaryotes

30. lysosome and centrioles

Answer key

For End of unit Review Exercises

Part I Answer key for True/ False item

1. False
2. False
3. True
4. True
5. True
6. True
7. True
8. True
9. True
10. True

Part II Answer key for multiple choice Item

11.C 13.B 15.C 17.B 19.A

12.C 14.D 16.B 18.C 20.D

Part III. Answer key for fill in the blanks spaces Item.

21. Cell wall
22. Lysosomes
23. Vesicles
24. Organ
25. Isotonic solution

Part IV Answer key for fill in the blanks spaces of the table

Table 3.5

- A. Circulatory system
- B. Ovary/ Testes
- C. Stomach/ Intestine
- D. Roots/ stem
- E. Vascular system
- F. Brain / spinal cord

UNIT 4

Reproduction

4.1 Introduction to Reproduction

What is reproduction?

☑ **Reproduction:-** is the process of producing new organism (or offspring).

☑ Some offsprings are produced by two parents, and others are produced by just one parent.

☑ Some organisms look exactly like their parents and others look very similar.

☑ Whether an organism is identical or similar to its parent is determined by the way that the organism reproduces.

☑ All living things reproduce.

☑ Reproduction allows the survival of different species of living things.

☑ The way in which living things reproduce differ from species to species.

There are two major types of reproduction.

A) Asexual reproduction

B) Sexual reproduction

4.2 Review of Asexual Reproduction

☑ In asexual reproduction only one parent is needed to reproduce (or to have young)

☑ When reproduction requires only one parent it is called asexual reproduction.

☑ Asexual reproduction is called a simple forms of reproduction.

Characterstics of asexual Reproduction

1. Egg and sperm cells are not used. Therefore, their is no meiosis types of cell division (cell reproduction).
2. Organs such as ovaries and testes are not used because no egg and sperm are produced in asexual reproduction.
3. Mitosis, a type of cell reproduction is involved
4. The offsprings reproduced are identical to one another and the parent.
5. They have the same kinds of chromosome materials and the same traits.
6. The offsprings are clone.

Example: Bacteria, fungi, many invertebrates, unicellular eukaryotic and plants.

Advantages of Asexual Reproduction:

What are the advantages of asexual reproduction?

Explanation

☑ No mate is needed.
☑ No gametes are needed (no sperm and egg cell).
☑ No ovary and no testes are needed.
☑ All the good characterstics of the parent are passed on to the offsprings.
☑ Offspring will grow in the same favourable environment as the parent.
☑ Offsprings are clone.
☑ Asexual reproduction allow organisms to produce many offsprings in a short period of time.

What are the disadvantages of asexual reproductions?

Explanation

☑ There is little variation is created
☑ Adaptation to the changing environment is unlikely.
☑ If the parent has no resistance to a particular disease, none of the offspring will have resistance.

☑ Lack of dispersal can lead to competition for nutrients, water and light.

B. Review of Sexual Reproduction

☑ In sexual reproduction there are two parents are required. These are the male parent and the female parent.
☑ The male parent called pathernal and produce sperm cells (male gametes).
☑ The female parent called mathernal and produce egg (ovum) cells (female gametes).

The Major Features of Sexual Reproduction

1. Sex cells (gametes) are produced.
2. Sex cells are formed in the organs.
   ➥ Testes (testicles) in male produces sperm cells.
   ➥ Ovaries in female produces egg (ovum) cells.
3. Meiosis is a type of cell reproduction or cell division that form the sex cells (gametes).
4. **Fertilization is needed:-** Fertilization is the process that brought male and female sex cells together to form zygote. Gametes are the sex cells. These are: The female gamete is called egg (ovum) and the male gamete is called sperm cell.
5. The offsprings reproduced by sexual reproduction will not look alike. They do not look exactly like either parent. sexual reproduction forms offsprings with different features.

Sexual Reproduction: Have,

➥ Sex cells (gametes).
➥ Sex organs (Ovaries and Testise)
➥ Meiosis type of cell reproduction is used
➥ Their are mating and fertilization
➥ The offsprings produced are different.
➥ Mitosis cell division occur after fertilization & zygote formation.
➥ Genetic variation occurs in sexual reproduction.

Example:- All insects, All seed-bearing plants, all chordates (or vertebrates).

➥ Some simple animals like hydra and planaria can use sexual reproduction in addition to asexual reproduction.

By Conjugation:- Sexual reproduction can also be taken place in paramecium (Isogametes) which is similar gametes and fungi (Rhizopu bread mold) by the fusion of spores results zygospore. The process is calle conjugation.

Conjugation: is the simplest kind of sexual reproduction is calle conjugation.

4.3 Types of Asexual Reproduction

The basic formes of asexual reproduction are:

- Fission
- Fragmentation
- Budding
- Vegetative propagation
- Parthenogenesis
- Sporulation

What are the difference and similarities are observed among the different type of asexual reproduction?

4.3.1 Fission

What is fission?

In fission the organism (one celled) divided in to two equal parts (by binar fission) or in to more equal (by multiple fission).

Binary fission:- Parental cells such as bacteria, protozoa (amoeba paramecium, plasmodium, etc) and algae divided in to two equal parts i called binary fission.

- The newly produced cells are called daughter cells.
- The daughter cells are identical to each other and with their parents
- The daughter cells become an independent organism.

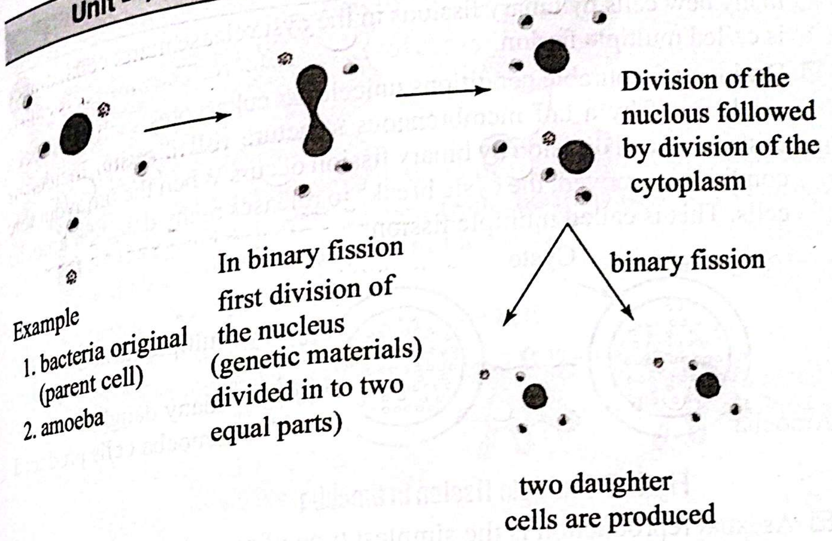

Division of the nuclous followed by division of the cytoplasm
binary fission
In binary fission first division of the nucleus (genetic materials) divided in to two equal parts)
Example
1. bacteria original (parent cell)
2. amoeba
two daughter cells are produced

Fig 4.1 Binary Fission in Amoeba (bacteria)

The two New Organisms Produced by Binary fission are:

☑ Identical to each other and with the original parental cell (bacteria) or amoeba.

☑ They have equal chromosome number to each other and with the parent cell.

☑ One bacteria can be divided in to two new cells (daughter cells) in every 20 minutes.

☑ The daughter cells under go repeated cell division and form a group of genetically identical cells called a bacterial colony.

Fig 4.2 Bacterial colony (Aball of cells)

☑ All prokaryotes reproduce asexually by binary fission many unicellular eukaryotes also reproduced asexually by binary fission. such as protozoans (amoeba, plasmodium, paramecium) reproduced by splittes in to two equal parts called binary fission.

☑ **Multiple fission:-** original (parental) cell like amoeba divided in to many new cells by binary fissions in the cyst release many cells at o is called multiple fission.

☑ During unfavourable conditions unicellular eukaryotes such as amoe shield itself by a taff membraneous structure called cyste. Inside cyste rapid cell division by binary fission occurs When the unfavour conditions removed, the cyste breaks to releases many daughter amoe cells. This is called multiple fission.

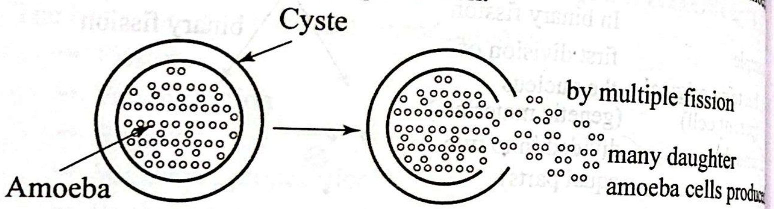

Cyste
Amoeba
by multiple fission
many daughter amoeba cells produ

Fig 4.3 Multiple fission in amoeba

☑ Asexual reproduction is the simplest type of reproduction

☑ Asexual reproduction is the most efficient method of reproduction.

☑ Asexual reproduction allows organisms to produce many offsprings i a short period of time.

4.3.2 Fragmentation

What is fragmentation?

Fragmentation is a type of asexual reproduction in which the body break in to several pieces. These fragments regrow the missing parts and develop in to complete adults.

Example: Star fish, fungi, plants, animals, & algae.

Example

1. Spirogyra, a filamentous green algae
   - ➥ Under go fragmentation, which results in many filaments. Eac filament grow in to many filaments.
2. Worms, break in to two or more parts, with each fragments becomi a complete individual.
3. Many invertebrates, can reproduce asexually by breaking in to two parts and regenerating the missing parts of the fragmentation.
   - ➥ Regeneration is the process of replacing the missed (lost) parts of the organism and becoming a complete individual is called regeneration.

4.3.3 Budding

What is budding?

Budding is the type of asexual mode of reproduction in which small, out grow of organism that developed from the parental cell called bud, that grow in to a complete independent individual.

Example: Yeast and Hydra

☑ The bud is unequal to the parent cell.

☑ Example: Yeast (fungi) and Hydra (invertebrate)

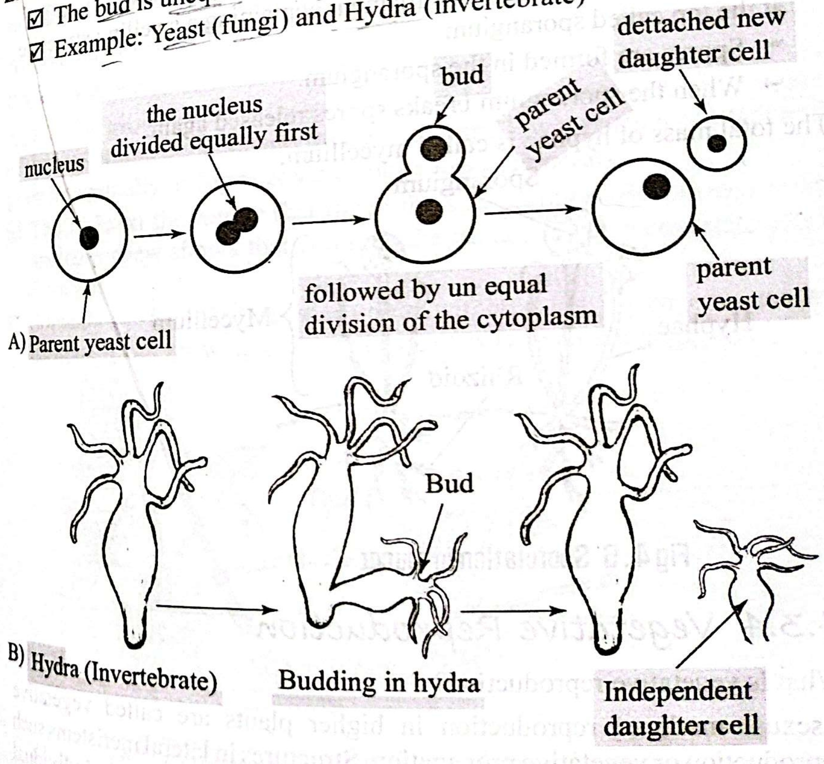

dettached new daughter cell
bud
the nucleus divided equally first
parent yeast cell
nucleus
followed by un equal division of the cytoplasm
parent yeast cell
A) Parent yeast cell
Bud
B) Hydra (Invertebrate)
Budding in hydra
Independent daughter cell

Fig 4.4 Budding in A) yeast and B) Hydra

Sporulation

What is sporulation? Sporulation is the formation of spores. Spores are powdery - like cells.

- ☑ **Sporulation:-** is the mode of asexual reproduction in which many spores are formed by sporulation.
- ☑ Formation of spores in fungi such as mucor, mushroom, bread mold, pencillium. from other species such as mosses, ferns & Algae reproduce by spores called sporulation.
- ☑ Spores are dispersed by air and land on dead, organic matter.
- ☑ Where they grow in to new hyphae.
- ☑ **Hyphae:** is each thread - like filament containing a swelling structure at the top called sporangium.
  - ➥ Spores are formed in the sporangium.
  - ➥ When the sporangium breaks spores released again.

The total mass of hyphae is called mycellium.

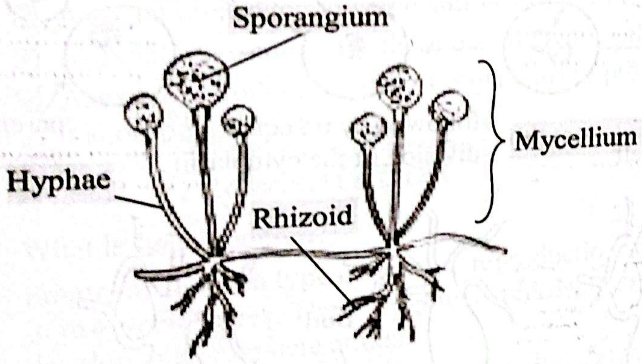


Fig 4 . 5 Sporulation in mucor

4.3.4 Vegetative Reproduction

What is vegetative reproduction?

Asexual mode of reproduction in higher plants are called vegetative reproduction or vegetative propagation. Structures in lateral meristems such as roots, stems, buds and leaves give to new self - supporting individual plants.

The following are types vegetative reproduction.

- ➥ Stolons (runners)
- ➥ Rhizome
- ➥ Corms
- ➥ Tubers
- ➥ Bulb

4.3.4.1 Vegetative Propagation by Stem

This includes both underground stem such as tubers, bulbs, rhizome, corm, stolon and runners.

A. Stolons (Runners)

What is a stolon?

A plant that grow horizontally stolons are subaerial stem along the surface of the soil. Runner contain auxilliary bud at the lower portion of plant and grow horizontally. It forms adventitious roots at intervals.

- ☑ The node on the runner that touch the soil produce adventitious roots and then anew shoots that continue the runner. Thus, a complete plant develop.
- ☑ Some times The stolon are dried up and withered, leaving an independent daughter plant growing a short distance away from the plan.

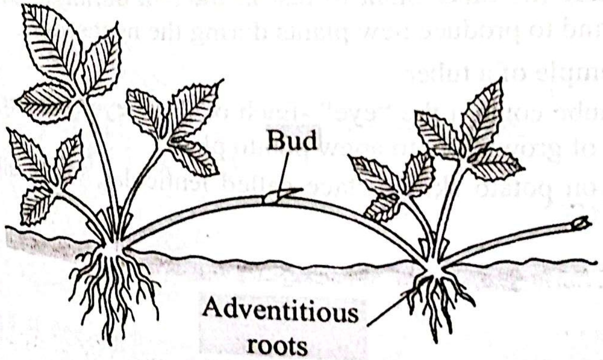


Fig 4 . 6 Reproduction using Runner (stolons)

Rhizome

What is rhizome?

Under ground stem that grow horizontaly along the ground is called rhizome.

- ☑ Shoots arise from lateral buds near the stem base that grow under the ground.
- ☑ Such under ground horizontal stem that grow along horizontaly is called rhizome.
- ☑ At the nodes of the rhizome are buds which develop to shoots above the ground. The shoots become an independent plant.

Example:- Many grasses (couch grass)
➥ Ginger and bamboo.

Corms

What is corms?

Corms are similar to rhizomes, except they are more rounded and fleshy (such as in gladiolus) corms contain stored food that enables some plants to survive the winter.

Example:- Crocus, Gladiolus, Gloriossa. merendra and many others produce corms.

Tubers

What is tuber:- Tubers are modified stems that store starch.

Example:- Potato tuber (Solanum species) .

- ➥ Tubers are enlarged, fleshy underground stems.
- ➥ Tubers help the tuber plant to rest in the soil during unfavourable seasons and to produce new plants during the next season.

Potato is an example of a tuber.

- ☑ The potato tube contain the "eye" -Each of these eyes is a very small bud capable of growing in to anew potato plant.
- ☑ Little holes on potato skin surface called lenticular, which allow air breathing.

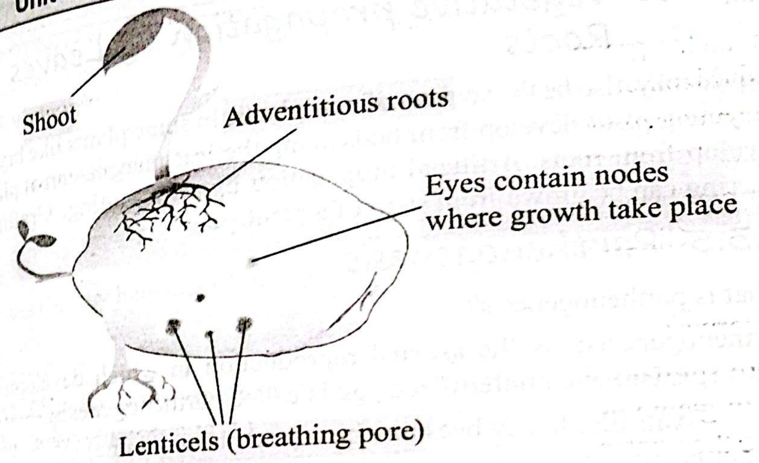

Shoot
Adventitious roots
Eyes contain nodes where growth take place
Lenticels (breathing pore)

Fig 4.7 Potato Tuber

Bulb

What is bulb?

A bulb is a modification of a stem that has the appearance of enlarged fleshy leaves emerging from the stem.

- ☑ It functions as an underground storage unit.
- ☑ Bulbs are short, vertical under ground stem covered by flesh leaves.

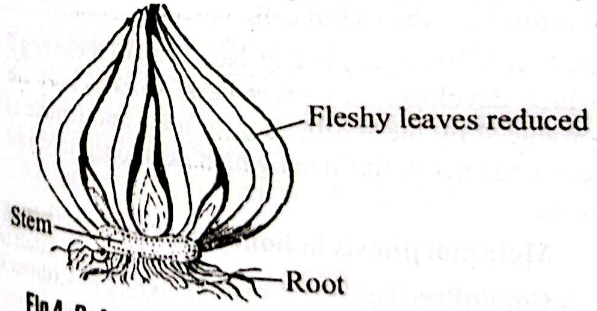


Fig 4.8 Asexual Reproduction in Bulb

4.3.4.2 Vegetative propagation by Leaves and Roots

Leaves may also be the sources of new plants. In some plants like bryoph the young plant develop from buds along the leaf margin. carrot plant develop from roots. Artificial propagation by stem cutting. Grafting layering can be grown from stem of a plant.

4.3.5 Parthenogenesis

What is parthenogenesis?

Parthenogenesis:- is the asexual reproduction in which development new organism from unfertilized egg is called parthenogenesis.

Example: honey bees in a hive (male bees - drone)

The unfertilized egg of the honey bees laid by the queen developed in anew organism called drone. Drone is a male bee developed only from th egg with out being fertilized.

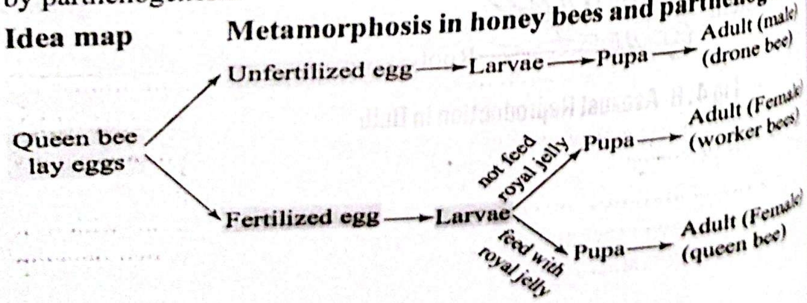
Unfertilized egg → larva → pupa → Adult (Drone) (male)

This type of metamorphosis in bees in which the unfertilized eg alone developed (or hatched) in to new organism (the drone) is calle parthenogenesis.

➥ Parthenogenesis is asexual reproduction because the egg do not ge fertilized (unit) with the sperm cell.

A queen bee might lay 2,000 eggs per day. Nearly all of these egg fertiliz by the sperm which developer to worker bees. worked bees are fema bees They are produced by the fertilization of male and female sex cell But some of these eggs get unfertilized which developed to drone (mal by parthenogenesis.

Idea map **Metamorphosis in honey bees and parthenogenes**



Male bees (the drone) from the bee colony derived through parthenogenesis, a form of asexual reproduction in which unfertilized egg developed in to an adult organism.

Example 2. Whip tail lizard (**A spidoscelis uniparens**) produces females by parthenogenesis. Thus, each new lizard develops solely from one her mother's eggs, meaning that is a clone of her mother.

Conceptual Example

1. Discuss the mechanisms of multiple fission

Explanation

Multiple fission when the nucleus of the organism divide repeatedly by binary fission and each daughter nucleus slitted together with half of the parental cytoplasm, resulting in the production of many daughter cells.

2. When food is left open, the faste and smell of food changes? Why?

Explanation

It is due to the decomposing effects of fungi and bacteria?

3. What is parthenogenesis? Explain it by giving Example.

Explanation

Parthenogenesis is a type of asexual reproduction in which new organisms developed from unfertilized eggs. Example Honey bees in a hive The male bees called drone is produced from unfertilized egg called parthenogenesis.

4. What is fragmentation, fission, and Budding?

Explanation

Fission:- in binary fission the body of unicellular parent divides by mitosis in to two equal parts, each developed in to individual which is similar to each other and to ther parent In multiple fission, many cells produced.

Fragmentation:- is common asexual reproduction in which it involves the breakdown of parent organism in to parts that develop in whole organism.

Budding:- The process of developing small, out - grow of organis (the bud) that detached and grow in to independent organism.

Illustrative Example

5. One of the following is not reproduced asexually by sporulation.

A) Mucor
B) Pencillium
C) Ferns
D) Mosses
E) None

Explanation

Organisms reproduced a sexually by sporulation are mucor, pe cillium, Ferns, mosses, algae, mushroom & bread mold.

Answer: E

6. Asingle thread - like filament that grow from spore is called

A) Sporangium
B) Mycellium
C) Spore
D) Hyphae

Explanation

When spore land on organic matter, it grows in to a single thread-like filament called hyphae.

Answer: D

7. The total mass of hyphae is called ____

A) Rhisoid
B) Sporangium
C) Mycellium
D) None

Explanation

The total mass of hyphae is called my cellium

Answer: C

8. A type of asexual production in which a small - out grow of organism from the parent cell that later developed in to an indepent organism is called.

A) Spore
B) bud
C) Nucleiod
D) tentacle

Answer: B

9. It is a types of asexual reproduction in which it is a process of developing the lost parts of the organism in to a complete body is ____

A) Regeneration
B) Sporulation
C) Budding
D) None

Answer: A

10. A type of asexual reproduction in which the parental cell divided in to two equal parts is called ____

A) Binary fission
B) Regeneration
C) Fragmentation
D) Budding

Answer: A

4.4 Sexual Reproduction in Humans

What is sexual reproduction?

☑ Sexual reproduction involves the production of sex cells.
☑ Sexual reproduction always involves two parents organisms.
☑ The sex cells are called gametes.
☑ Gametes are formed in the reproductive organs.
☑ The testes (testicles) produce sperm cells in male.
☑ The female ovaries produce egg (ovum).
☑ The gametes are produced through meiosis.
☑ Sexual reproduction starts with the union of sperm and an egg in a process called fertilization.
☑ Fertilization results the formation of a single cell called a zygote.
☑ Zygote is a fertilized egg.
☑ The zygote then grow in to anew individual called blastula (Ball of cells)
☑ Mitosis cell division starts at the zygote stage where a number of ball of cells are formed and grow takes place.
☑ The egg cell (ovum) is larger than the sperm cell and is not mobile like sperm cell.

4.5 Primary and Secondary Sexual Characterstics

The Primary sexual characterstics

What are the primary sexual charaterstics?

The human males are born with the penis, scrotum, and testicles (testes). where as the females are born with the vagina, ovary and uterus (or womb) respectively.

☑ These are the primary sexual charaterstics in male and females
☑ They are immatured stages both in males and females.

☑ Atpuberty or adolescent stages of development these characters changed.

The Secondary Sexual Characterstics

What is the secondary sexual characterstics?

- ➥ It is the sexual maturity stage is reached.
- ➥ The sexual maturity stage means that the potential for sex reproduction exist.

☑ The puberty or adolescence stage begin in male at the age of 12- years old. It's the time when secondary sexual characterstic began develop and sexual maturity stage reached.

☑ The secondary sexual characterstics are not primary involved formation and delivery of egg or sperm, but that are essential behavioral and functional success of reproduction.

The secondary sexual charactertics in male include:

☑ Deepening of voices.
☑ Growth and maintenance of the male sex organ (sperm cell)
☑ Increase in muscle mass and strength of the body.
☑ Increased growth of the long bones of the arms and legs.
☑ Appearance of pubic hair in the groin and arm pit
☑ Appearance of hair on the face.
☑ Widening of chest and shoulder.
☑ Production of sperm cells by the testes.
☑ Feeling of Independence & questioning, develops.

What Role Do Hormones Play in Puberty?

☑ Hormones secreted from the endocrine glands have roles in controlling the development and activity of the male reproductive system.

☑ The changes that occur during puberty are controlled by sex hormon

☑ Sex hormones are secreted by the endocrine glands called gonads. Th male gonad is testes and the female gonads is called ovaries.

☑ The hypothalamus of the brain part initiate (or stimulate) the pituit gland with the neural impulse.

☑ The pituitary gland is a small bean - shaped endocrine gland located the base of the brain, then secrete two hormones:

☑ The two hormones secreted by the pituitary gland are follicle stimulating hormone (FSH) and luteinizing hormone (LH).

☑ When FSH and LH are released in to the blood stream, are carried to the testicles. Testicles or testes are the male gonads.

☑ In the testes, FSH causes the production of sperm cell.

☑ LH causes the endocrine cell in the testes to produce the male hormone called testosterone.

☑ Testosterone influences the production of sperm cells.

☑ Testosterone is responsible for the growth and development of secondary sexual characterstics in male.

☑ FSH and LH are also secreted in females and influence the development of secondary sexual characterstics.

☑ Puberty in femals begins at 10 - 13 years old.

☑ In female LH causes eggs to be released in to the oviduct (fallopean tube) where as FSH stimulates the development of follicles in the ovary.

☑ A follicle is a group of epithelial cells. These epithelial cells surround a developing egg cell. FSH also causes a hormone called eostrogen to be released from the ovary.

☑ Eostrogen is responsible for the secondary sexual characterstics in females.

☑ The secondary sexual charactertics in female includes:

- ➥ Development of breast.
- ➥ Increase in growth rate of the long bone of arms and legs.
- ➥ Development of pubic hair in the groin and also in the arm pits.
- ➥ The hips or pelvis broaden and more fat is deposited in the breasts.
- ➥ Menstrual cycle begins.
- ➥ Production of egg (ovum) takes place.

4.6 The Male Reproductive Structure

What are the main functions of the male reproductive organs?

Explanation

- ➥ The main functions of the male reproductive organs is to produce sperm and deliver them to the female.

The reproductive organs, glands and hormones of the ma reproductive system are:

- ➥ Testes (or testicles)
- ➥ Penis
- ➥ Epididymis
- ➥ Vas deference and
- ➥ Accessory glands
- ➥ Testosterons.

☑ **Hormones are:** Testosterone that cause the developments of the mal secondary charactersties.

☑ Sperm cell (male gamete) production sites are the two testes (testicles)

☑ Sperm cell production development takes place in the seminiferous tubules of the testes.

☑ Between the tubules are cells, which produce the male sex hormone called testosterone.

☑ The scrotum is a sac - like suspended out side the abdominal cavity, tha permanently hold the testes (testicles). This is because to provide lowe temperature for testes than the body.

☑ Sperm cells produced at a temperature lower than the body temperature

☑ Sperm cell travel from the seminiferous tubules to epididymis, where sperm maturation occurs and then to a vas deferense, the ejaculatory duct

☑ The vas deferences join the urethra;

☑ Urethra: a duct that carries both sperm cell and the urinary products ou side through the penis.

☑ The testes composed of seminiterous tubules (produce sperm cel → sperm collected and stored where sperm maturation occurs epididymis (sperm kept here until ejaculation → then to vas deferen (ejaculatory duct) → then through urethra → in to the female organ.

Accessory Glands

There are three sets accessory glands open in to the reproductive channels These are:

- ➥ A pair of seminal vesicles
- ➥ A single prostate gland
- ➥ The pair of bulbourethral glands.

☑ Fluids secreted by these glands furnishes food to the sperm, lubricate the female reproductive tract for sperm, and counteracts the acidity of the vagina so that the sperm retain there viability longer after being deposited in to the female.

Semen: is a mixture of sperm, proteins, nutrients, ions and signaling molecules.

- ➥ Sperm constitute less than 5% of semen volume

semen = sperm cell + fluids.

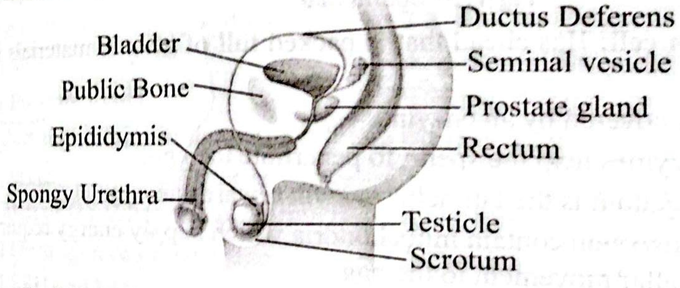


Fig 4.9 The Male (Human) Reproductive System

Key terms

Seminiferous tubules: In side a testes, coiled tubules that contain male germ cell and produce sperm.

Bulbourethral glands: secrete a lubricating mucus in to the urethra, which helps clear the urethra, of residual urine.

Epididymis: a pair of ducts in which sperm formed in testes are matured, each empties in to a vas deference.

Prostate gland: produces alkaline secretions that help raise the PH of the female reproductive tract.

- ➥ Making this passage more suitable to sperm.

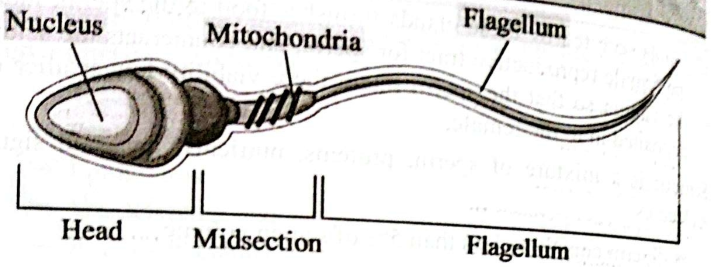


Fig 4.10 Sperm Cell

The sperm cell: Has ahead that is packed full of genetic materials in the nucleus.

☑ Head is covered by an enzyme.

☑ The enzymes help the sperm to penertrate the egg.

☑ The flagellum is the tail helps to swin towards an egg.

☑ The midsection contain mitochondria which supply energy required for flagellar movement to the egg.

☑ Sperm cell is formed in the testes in the tubules called seminiferous tubules.

☑ The process of sperm production is called spermatogenesis.

☑ The process of egg (ovum) production is called oogenesis.

☑ The process of both sperm and egg cell production is called gametogenesis.

Supplementary Exercises

Part I choose the best answer from the given alternatives

11. The male and the female gonads are respectively
A) Ovary and testes
[✓ B) Testes and ovary]
C) Testes and oviduct
D) Fallopean tube & vas deference

12. One of the following is **Not** the secondary sexual charactertics of male?
A) Ejaculation of sperm
B) Deepening of voice
C) Periodic flow of menstruation
D) Enlargement of penis

13. Sperm and testosterone are produced by:
A) Epididymis
[✓ B) Testes]
C) Ovary
D) Vas deferences

14. The temporary storage of sperm cll is ____
[✓ A) Epididymis]
B) Vas deference
C) Seminiferous
D) Testes

15. The ejaculatory duct of sperm in the testes is called ____
A) Epididymis
[✓ B) Vas deference]
C) Seminiferou tubules
D) Testes

16. The release of sperm through the penis is ____
A) Copulation
[✓ B) ejaculation]
C) Fertilization
D) Period

17. One of the following is not an accessory glands
A) Seminal vesicles
B) Prostate gland
C) bulbourethral gland
D) None

18. A duct that carries both sperm cell and urine is
A) ureter B) uterus C) urethra D) Vas deference

19. Which of the following hormone is secreted from the pituitary gland:-
A) Oestrogen & progestrone
[✓ B) FSH and LH]
C) Testosterone
D) Oestrogen

4.7 The Female Reproductive Structure

What are the functions of the female reproductive organs?

☑ A human female's gonads - her ovaries - lies deep inside her pelvic cavity. They produce and release egg.

☑ The ovaries also secretes a females sex hormons called oestrogen and progestron.

Oestrogen Hormone: causes the development of the female secondary sexual characterstics.

Oviduct (fallopean tube): a hollow tube that connects the ovary to the uterus.

- It is a site where fertilization takes place (i.e sperm and egg unit together).

Uterus (womb): A uterine lining consistes of glandular epithelium, connective tissues, and blood vessels.

- A fertilized egg implanted in to the uterus and developments of the embryo takes place.

Labia majora and labia minora: External visible organs of the reproductive tract are called genetals.

- The female genitals includes the opening of the vagina and uretha. The two pairs of liplike skin folds that enclose this opening are called labia majora and labia minora.
- Adipose tissue fills the thick outer folds are the labia majora.
- Thin inner folds are the labia minora.

Clitoris:- It contains erectile tissue like the male penis and highly sensitive to tactile stimulation.

The pair of ovaries of the human female contain many eggs, and the baby girl born with these eggs. But matured egg released from the ovaries after maturation (puberty stage) one at a time.

☑ Usually the ovaries alternate in releasing the eggs. Because woman is fertile for only about 30 years, of the approximatly 4.0×10^5 eggs in her ovaries at birth, from which only 300 to 400 have chance to reach maturity, the others degenerate.

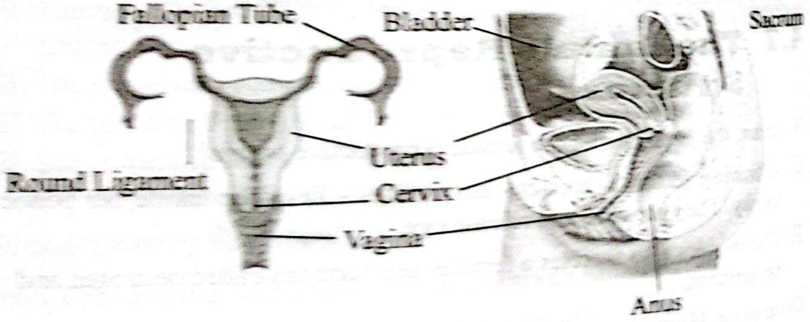


Fig 4 . 11 The Female Reproductive System

4.8 Ovulation and the Menstrual Cycle

What is ovulation?

In humans, egg production occurs before birth. At puberty or adolescence stage hormonal changes prompt eggs to mature, one at a time, in every 28 days of ovarian cycle. As the cycle begins, the follicle enlarges and a fluid-filled cavity forms around it. About two weeks after the follicle begins to

mature, its walls ruptures and ovulation occurs (egg released). The egg and surrounding follicle cells are ejected in to the adjacent oviduct (fallopean tube). This the 14th date after the beginning of the last menustruation. in which the egg released in to the oviduct (fallopean tube) leaving the ovary is called ovulation date. After ovulation, cells of the ruptured graafial follicle in the ovary develop in to hormone secret called corpus luteum. the hormone secreted from this corpus luteum is called progestrone hormone.

Progestron Hormone has the Following Major functions:

1. Causes the uterus wall (womb) to thicken and become spongy, and ready to recieve the fertilized egg.
2. Stimulate the development of net works of blood capilliaries (blood vessels) in the uterus lining.
3. Stops ovulation

☑ The uterus is now ready for pregnancy. The progestron hormone prepares the uterus to recieve a fertilized egg.

☑ If pregnancy does not occurs, the corpus luteum breaks down, and stop producing progestron hormone. If progestron hormone is not produced, the uterus wall disintigrated, the net works of blood capilliaries are not formed and also the egg died.

☑ Thus, the disintigrated uterus wall, the blood vessels formed on the uterus wall together with some blood and the dead. egg discharged as a blood through the vagina. This is called menstruation or period.

☑ This periodic discharged blood is called menstruation or period.

☑ The process of discharging blood periodicaly that occurs in every 28 days is called menstrual cycle. menstrual cycle include producing an egg and preparing the uterus for recieving an egg.

☑ Then a new follicle will begin to mature again.

☑ The word menstruation comes from latin, which means monthly. Because it occurs every month.

A woman enters menopause at the age 45 - 50 years old when all the follicles in her ovaries have either been released during menstrual cycle or have disintegrated as aresult of aging. with no follicles left to mature diminished production of oestrogen and progestron hormone and menstrual cycles cease.

Menopause is known only in humans and two species of whales.

Illustrative Example

20. Which of the following is a sources of a hormone progestrone?

A) Corpus luteum and placenta
B) Uterine wall and pituitary gland
C) The two fallopean tubes (oviducts)
D) Uterine wall and young follicles

Explanation

A hormone progestrone is produced by corpus luteum and placenta. It prepares the uterus for pregnancy.

Answer: A

21. Which one of the following organ produces estrogen and progetron hormones:-

A) Pituitary gland
B) Ovary
C) Oviduct
D) Uterus

Explanation

Ovary produces the female sex hormones (progetrone and oestrogenes)

Answer: B

22. Suppose a girl look like a boy in her external features, this situation could be due to the lack of the hormonal called:

A) Adrenaline
B) Testosterone
C) Eostrogen
D) Progestrone

Explanation

Esotrogen is a female sex hormone that gives her a female feature and behaviours.

Answer: C

23. Where there is no pregnancy after ovulation

A) Follicle is formed in the ovary
B) Eostrogen level increases.
C) Progestrone level decrease
D) The egg is released from the ovary.

Explanation

If there is no pregnancy after ovulation the level of oestrogen and progestrone in the blood declines.

Answer: C

24. Which of the following is a secondary sexual characterstics of male:-

A) Beginning of menstruation
B) Development of breast
C) Broadening of chest and shoulder
D) Production of ova from ovaries.

Explanation

The secondary sexual characterstics of males are:

- Deeping of voice.
- Broadening of shoulder and chest.
- Appearance of hair under arm pits, chest, groin, face, etc.
- Sperm cell start to produce.
- Sexual feeding to opposite sex, etc.

Answer:- C

25. When does the ripening egg brust out of the follicle at the menstrual cycle?

A) After 14 days from the monthly period has started.
B) After 20 days from the monthly period has started.
C) After 28 days from the monthly period has started.
D) After 10 days from the monthly period has started.

Explanation

Matured or ripen egg brusts out of the follicle (ovary) and moves to fallopian tube 14 days from the monthly menstrual flow has started. This is called ovulation.

Answer: A

Supplementary Exercise

Part II Choose the Best Answer from the Given Alternatively

26. The female secondary sexual characterstics involves all except:-

A) Widening of hips
B) Broadening of shoulder & chest

C) Development of breast
D) Menstrual cycle start.

27. The release of matured egg from ovary to fallopean tube is called ___
A) Implantation
B) Gestation
C) Ovulation
D) Copulation

28. The stopping or cessation of menstrual cycle in woman after reaching the age of 45 years and above is ______
A) Puberty
B) Adolescence
C) Preganacy
D) Menopause

29. The parts of the female reproductive organ where fertilization takes place is called ______
A) Uterus
B) Ceruix
C) Fallopean tube
D) Vagina

30. The female gonads produce the following ______
A) LH and progestrone
B) Progestrone & oestrogene
C) FSH and LH
D) Testosterone & FSH

31. The ovaries produce ______
A) FSH and LH
B) Sperm cell and testosterone
C) Oestrogen and ova
D) Progestron and testosterone.

32. One of the following is not the function of progestrone hormone:-
A) Stop ovulation
B) Causes the developments of blood uterus wall
C) Causes the uterus wall to thicken
D) None of the above.

4.9 Fertilization and Pregnancy

Mating and Fertilization

What is mating?

☑ Sexual arosal in the male results in an erection of the penis as aresult of blood flowing in to the erectile tissue (penis tissues).

☑ Arosal in the female results the lining of the vagina to produce mucus to lubricates the vaginal and makes it easy for the erect penis to enter.

☑ The sensory stimulus in the male results in ejaculation of semen in to the vagina.

☑ Semen is the mixture of sperm cell and fluids secreted in the male testes.

Sperm cells + fluids = Semen.

What is Fertilization

☑ Fertilization is the process of bringing male sperm cell and female egg (ovum) together.

☑ After ejaculation of semen in to the vagina, the sperm swims through the cervix in to the uterus by wriggling movement of their tails. They pass through the uterus and enter the oviduct (fallopean tube).

☑ In the oviduct (fallopean tube) fertilization takes place, when the sperm head penetrate in to the egg (ovum) cytoplasm and the sperm nucleus fuses with the egg (ovum) nucleus. This is the moment of fertilization is called pregnancy.

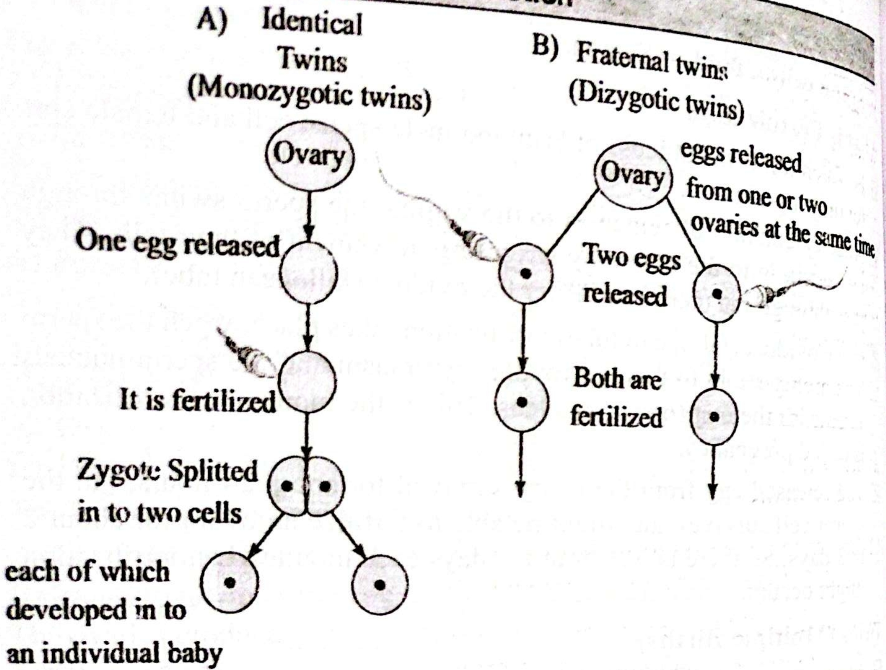
☑ The released egg from the ovary survived for about 24 hours, but the sperm cell survives and might be able to fertilize an ovum for about 2 to 3 days. So there is only four (4) days each month when fertilization might occurs.

Twins (Multiple Births)

☑ Many mammals including human can give birth to more than one offspring at a time is called twins.
- Twins can be grouped in to two types:
- Identical or monozygotic twins
- Non - Identical, or dizygotic or fraternal twins.

Identical or monozygotic twins:

☑ One sperm cell fertilizes the egg and zygote is formed. The single (one zygote) (monozygote) splitted up in to two forming identical twins.
- They have the same sex. (both of them are males or both of them are females).
- They have the same or identical genetic materials.
- 65% identical twins share a common placenta but 33% of them have a separate placentas.


A) Identical Twins (Monozygotic twins)
B) Fraternal twins (Dizygotic twins)
Ovary
One egg released
It is fertilized
Zygote Splitted in to two cells
each of which developed in to an individual baby
Ovary
eggs released from one or two ovaries at the same time
Two eggs released
Both are fertilized

A) Identical twins or monozygotic twins
- ✓ one egg
- ✓ one sperm
- ✓ one zygote
- ✓ the same individual

B) Non - identical (fraternal twins)
- ✓ different egg (ovum)
- ✓ different sperm cell
- ✓ different zygote
- ✓ different individual

Fig 4 . 12 A) Identical twins and B) Non -Identical twins

Fraternal Twins (dizygotic twins)

☑ Two eggs (ova) released from the same or different ovaries and get fertilized by a separate sperm cells and form aseparatedzygote or dizygotic twins.

- ➡ They are just similar to an ordinary siblings.
- ➡ They may or not have the same sexes.
- ➡ They have different genetic materials

Pregnancy and Development

What is implantation? The fertilized egg (Zyrote) first divided in to two cells. Each of these divides a gain, so producing four cells. The cell continue to divide in this way to produce a solid ball of cells by the process called mitosis cell division. By this process an embryo develops in to a ball of cells called blastula. This early embryo travel down the oviduct (or tallopean tube) sinks and attached in to the uterus lining by a process called Implantation.

☑ The embryo continue to grow and produces new cells that form tissues, organs, and an organ system.

☑ After 8 (eight) weeks, when all the organs are formed, the embryo is called afetus.

☑ One of the first organs to form is the heart, which pump blood to the fetus. Fetus heart beat is then detected.

☑ **Amniotic fluid:** The embryo enclosed in a fluid - filled sac called the amnion or water sac, which protects it from damage and prevents unequal pressures from acting on it. The fluid is called amniotic fluid.

☑ Oxygen and food nutrients needed for the embryo obtained from the mother's blood by means of structure called placenta.

☑ The placenta attached to the uterus lining and attached to the embryo by a tube called umbilical cord.

☑ Carbondioxide and other metabolic wastes removed from the embryo through the mother's blood stream.

☑ But blood from the mother entering to the placenta does not mix with the embryo's blood.

☑ The placenta continue to produce a hormone called progestrone. The progestrone hormone which prepares the uterus for implantation and pregnancy to takes place is produced from the corpus luteum in the ovary. After the tissues of the placenta established it is continue to produced the progetrone hormone.

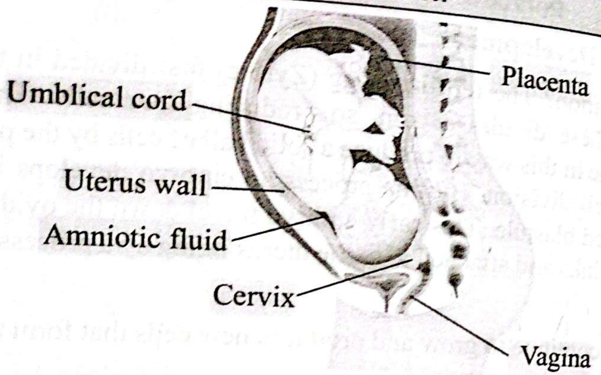


Fig 4 .13 Relationship between placenta foetus, uterus

Conceptual Example

Give short Answer for the following Questions.

33. State exactly what happens at the moment of fertilization

Explanation

The sperm enters the cytoplasm of the ovum and the male nucleus of the sperm fuses with the female egg (ovum) nucleus.

34. How do sperm differ from egg in their structure?

Explanation

- ➥ Sperm cell has smaller in size than the ovum (egg)
- ➥ Sperm cell has flagellum to move towards the egg but the egg has not.
- ➥ The egg contains reserved food for the developing embryo.

35. If mating takes place, state the dates of fertilization most likely to occur:-

Explanation

If sexual intercourse has taken place, fertilization would have been taken place two days before and two days after ovulation.

36. What is does the mid - piece of the sperm contain?

Explanation

- ➥ To keep optimum temperature for sperm cell survival.
- ➥ It's optimum temperature is lower than body temperature.

37. What does the mid - piece of the sperm contain?

Explanation

It contains mitochondria. mitochondria synthesise energy for the active motility of the flagella of the sperm.

38. What is the purpose of vas deference?

Explanation

Vas deference is a tube in the testes which ejaculates matured sperm cell in to the urethra and then out from the body.

39. What are the function of seminal vessicles and prostate gland?

Explanation

Fluid secreted by these glands furnishes food to the sperm, lubricate the reproductive tract for sperm and counteract the acidity of the vagina so that the sperm retain their viability longer after being deposited in the vagina of the female.

40. Which glands secrete alkaline fluids?

Explanation

Prostate gland produce alkaline secretions that help raise the PH of the female reproductive tract, making the passage (swim) of the sperm more conducive.

41. What are the three phases of the menstrual cycle?

Explanation

I. Flow phase
II. Follicular phase
III. luteal phase

42. What is shed during menstrual flow?

Explanation

The endometrium is shed during menstrual flow.

43. What two female hormones are secreted by the corpus luteum?

Explanation

Oestrogen and progestron. progestrone hormone cause changes to occurs in the lining of the uterus that prepare it to recieve a fertilized egg.

4.10 Method of Birth Control

What is contraception?

Contraception:- the deliberate prevention of fertilization or pregnancy (conception) is called contraception or birth control. Contraception (or birth control) can be achieved in a number of ways. This is called method of birth control.

Contraception Methods or Method of Birth Control:

I. By preventing gamete development

- ➥ By gamete release from male or female gonads.

II. By preventing fertilization

- ➥ By keeping sperm and egg apart

III. By preventing implantation of an embryo

☑ Unless prevented, mothers can give birth 4(four) weeks after giving birth.

☑ There fore, preventing birth or birth control to space out births and limit the size of family must be practiced.

☑ Implantation is the process by which foetus gets attached on the uterine lining (uterus wall).

☑ Contraception methods or methods of birth control can be practiced by:

- ➥ Natural methods of family planning.
- ➥ Artificial methods of family planning.

I. Natural Methods of family **planning**

A) Abstain (or abstinence)

- ➥ It is avoiding sexual intercourse.
- ➥ This method helps to prevent pregnancy as well as sexually transmitted diseases (pathogenes).

B) Monitoring body temperature

- ➥ Body temperature is slightly varies in menstrual cycle:
- ➥ During or soon after ovulation, a woman's temperature rises by

about 0.5°c.

- ➥ One day after the temperature returns to normal, a woman will be infertile.
- ➥ Continuous recording this temperature helps to control date of pregnancy.

C) Rhythem method

- ➥ It is called calendar method contraception.
- ➥ Fertilization takes place with in the oviduct (fallopean tube). so, calculating the date in which egg (ovum) reach in the fallopean tube help us to control pregnancy.
- ➥ And old by calculating the date or hourse in which the sex cells (gametes) alive in the uterus, pregnancy can be prevented.

Save period:- The time or period in which pregnancy could not be takes place is called the save period.

D) Cervical Mucus:

☑ The types of mucus secreted from cervic and vaginal lining is different in the menstrual cycle.

☑ As ovulation approaches the mucus becomes more fluid.

☑ Woman has to learn how to detect these changes and calculate how to calculate the ferfility period.

☑ By combining the calendar method (rhythm method) temperature method, cervical mucus method, it is possible to achieve about 80% success.

E) Breast feeding: Ovulation could not betakes place while breast feeding.

II. Artificial methods of family planning

What is the artificial method?

Artificial method of family planning is man - made method of birth control.

These are:

i. Barrier methods

- ➥ **Barrier method is preventing sperm cell and egg cell apart to prevent fertilization.**
- ➥ **These are: condom and Diaphragm.**
- ➥ **Condom: (male condom and female condom or femidom) prevent sperm and egg cell meeting (union).**

- Diaphragm is used cup (cover) the cervix and stop sperm entering the uterus.
- Diaphragm could not prevent sexually transmitted infections (STI).
- Barrier methods gives better protection against pregnancy 97% when combined with spermicide.

ii. Intra - Uterine Device (IUD) Method

It is also called loop. A small T - shaped plastic and copper device (coil), can be inserted by a doctor or nurse in to the wall of the uterus.

- IUD prevents implantation of a fertilized egg.
- It does not prevent fertilization but prevent implantation & pregnancy.
- About 98% effective in controlling pregnancy.
- It does not prevent STI.
- It stays in the uterus for about five (5) years.

iii. Hormonal methods

A) Contraceptive pills

☑ The contraceptive pills contain chemical hormones called oestrogen and progestron.

☑ The chemical hormones have the same effect on the body as the natural hormenes.

☑ The hormone suppress ovulation and so prevent conception.

☑ The pills need to be taken each day for the 21 days between the menstrual periods.

☑ They are 99% effective

☑ The pills does not prevent STI's.

B) Contraceptive injections

☑ The progestron hormon containing injection given to woman every 2 to 3 months (8 to 12 weeks).

☑ It works by thickening the mucus in the cervix, stopping the sperm reaching the egg.

☑ It is effective method it properly administered.

☑ It also thin the uterus lining, making it unsuitable for implantation.

☑ Does not prevent STI's.

C) Norplant

☑ Contraceptive implant is called norplant

☑ It is small plastic tube about 4cm containing progestron hormone, which is inserted under the skin of the arm of a woman by a doctor or nurse.

☑ One placed, slowly release the hormone for 5 years preventing pregnancy.

☑ It is 99% effective and successful in preventing pregnancy.

☑ It does not prevent against STI's

IV. Surgical method

A) Vasectomy:- It is male sterilization.

- The male sperm duct is cuts and tied at the end.
- His semen contain the secretion of the prostate gland and seminal vessicles but no sperm so can not fertilize an ovum.
- It is permanent method of sterilization and can not be reversed effectively.
- But reversing the sterilization some times is effective.
- It is 100% effective method.
- Sexual desire, erection, copulation and ejaculation are quite un-affected.
- The testes continuously produce sperm and testosterone.

B) Laparotomy or Tubaligation

- It is the female sterilization method.
- It is done by operation in which the oviducts are cut and tied. or blocked called tubectomy.
- The ovaries are unaffected.
- Sexual desire and menstruation cycle continue as before.
- Ova are released but blocked at the oviduct.
- It is permanent method of contraception, can be reversed but not an easy take.
- It is 100% effective and success ful in preventing pregnancy.
- Sterilization is the permanent prevention of pregnancy either by preventing gamete production from the ovaries or release.

Table 4 . 1 Effectiveness of the Contraceptive Methods

Contraceptive method	Effectiveness
Rhythm or calendar method	90%
Condom (Male & female condom)	97.5%
Diaphragm	97.5%
Pills (contraceptive pills)	99.5%
Hormonal injection	99%
Hormonal implant (Norplant)	99%
Sterilization (vasectomy and tubectomy)	100%
IUD (Loop)	97.5%

Conceptual Example

44. What is the disadvantage of diaphragma?

Explanation

It is does not prevent the risk of transmission of STI'S

45. What are the disadvantage of vasectomy and laparotomy?

Explanation

The operation can not usually be reversed.

46. Why is abstinence important for the youth?

Explanation

It is to avoid the chance of unwanted preganacy and to make the chance of contraction sexually transmitted infection low.

47. Mention the advantage and disadvantages of each contraceptive methods.

Table 4 . 2 Advantage and Disadvantage of contraceptive Methods

Contraceptive Methods	Advantages	Disadvantages
1. Absinence	☑ No sexual contact ☑ No fertilization ☑ No STI's	No
2. Monitoring body temperature	Reduce the side effect of some contraceptive methods.	Not very reliable not simple, no rehable way to recognize ovulation.
3. Cervical mucus	Could be combined with other methods calender, Temperature.	Not 100% effective.
4. Condom	Trapes the sperm & prevent them from reaching the uterus. ☑ Prevent the transmission of STD.	Not 100% effective.
5. Diaphragm	Covers the cervix and stop sperm entering the uterus.	☑ Does not prevent the risk of transmission of STI's.
6. IUD	Prevent Implantation of a fertilized ovum.	☑ Does not prevent against STI's.
7. Contraceptive	☑ Supress ovulation ☑ Prevent conception	☑ The pills does not protect against STI's.
8. Vesectomy and laparotomy	☑ Both prevent the passage of sperm & egg. ☑ 100% effective.	☑ Can not usually reversed. ☑ does not protect against STI's.

CS CamScanner

4.11 Sexually Transmitted Infection (STI'S)

Transmission and Prevention

Transmission:- Like all other systems, the human reproductive systems can be invaded by microbes. This invasion can result in disease being passed from person to person during sexual contact.

☑ Diseases transmitted through sexual contact are called sexually transmitted infection or STI's

☑ STIs can damage the reproductive system as well as other body systems.

☑ The diseases Gonorrhoea, syphilis & chlamydia caused by bacteria. They can be treated and cured with antibiotics.

☑ Trichomoniasis, which is caused by flagellater protozoa, *Trichomonas vaginalis*. It can be treated by anti - protozoa drug cure the infection.

☑ AIDS and genital herpes are caused by virus. They are not curable.

☑ Candidiasis, caused by *candida albicans* (thrush) species of fungus. It can be treated by anti - fungal drug.

Today sexually transmitted infection /STI's/ is used by some authorities to indicate that the microbes responsible for them do not always cause symptoms and sign of disease. They have no symptoms or the symptoms in the early stages are very mild. Many of the STI's can cause great harm if they are not detected and treated in these early stages. They can cause:

- Infertility
- Brain damage
- Death.

1. Gonorrhoea (Gonococcal Infection)

☑ Gonorrhoea is an infection caused by the bacterium **Neisseria gonorrhoea.**

The gonorrhoea gems are found in the mucus are of the body:

- The vagina
- Penis
- Throat
- Rectum

☑ Found in younger people (age 15 - 30) who have many sex partners.

☑ Gonorrhoea is reported more frequently from urban area than from rural areas.

Transmission

- It is spread through sexual contact
- Having unprotected sex (with out using condom)
- Particularly having many sexual partners.
- And also mother to child during birth.

Symptoms

During men infected with gonorrhoea have urinating yellowish - white discharged from penis

Control and prevention

1. Abstain /have no sexual partner/
2. Be faithful to one partner
3. Use condom (men or women condom)

2. Syphilis

Syphilis is a bacterial infection caused by the spiral - shaped **Treponema pallidum.**

☑ Any sexually active person can be infected with this STD.

☑ Like gonorrohea, the most common way of syphilis transmission is by sexual contact with infected person.

☑ It is also spread like gonorrohea - the exception is congenital syphilis, which is spread from mother to foetus.

☑ However, syphilis can not spread by contact with toilet seats, baths, shared clothing. symptoms.

☑ In the earlier stages it can be treated, but in the late late stages it can not.

The symptoms occurs in stages called primary, secondary and tertiary (late).

The primary sign of syphilis is a sore or sores, which are painless and found in penis and on the entrance of vagina, in the mouth, in the rectum. The sores may last from one to five weeks. The second stage of the disease. The most common symptom is rash. other symptoms includes:

- Tiredness,fever
- For sore throat, headaches
- Loss of appetite

- ➥ Patchy hair loss
- ➥ Swollen glands.

This symptom is will last two to six weeks. But unthreated the disease then goes in to along quiet phase. The tertiary or late phase, syphilis of over four years duration, may involve illness in skin, bones, cetral nervous system and hears. It causes severe and irreversible problems that can not be treated successfully.

3. Chancroid

Chancroid is a bacterial STD's that is more commonly seen in men than in women. It is caused by the bacterium **Haemophilus ducreyi**. It produces painful sores, usually in the head of penis It can be cured using antibiotics.

If some one have sex with some one who is HIV - positive and have open chancroid ulcer, the risk of becoming HIV - positive increases.

Table 4 . 3 Sexually Transmitted Infection

Disease /Infection/	Symptoms	Problems
1. Trichomoniasis	☑ Female some yellowish discharged fluid, & sore itchy vagina. Some have no symptum. male: prostate enlargment	☑ Cause infertility in both sexes. ☑ Prostate cancer in male.
2. Gonorrhea	Female: pus like discharge from vagina, painful urination. ☑ No symptoms in many women male: pus discharge from penis painful urination.	Female: sterility - Passed to new born form infected mother during birth. Male: infection of the testis
3. Syphilis	☑ Sore on vagina or penis followed by rash, sore throat swollen glands.	☑ Damage to hear & brain, passed from mother to foetus.
4. Chlamydia	☑ Similar to gonorrhea. ☑ No symptoms in 70% of female 10% males.	☑ Females: sterility problem of pregnancy ☑ Male: sterility.
5. AIDS	Fever, night sweating, dry cough, weight loss, swollen glands, constant tiredness.	☑ Destruction of the immune system, pneumonia, cancer, fatal after long illness.
6. Genital Herpes	Blister - like cut or sore on vagina or penis, may look like a rash.	☑ Passed to new born from infected mother during birth.

How can a person prevent the chance of getting STD's?

- ☑ The best way of preventing STDs is avoid sexual contact called abstinence (or abstain).
- ☑ A second way is to use a condom during sexual contact.
- ☑ A third way is to have sexual contact with only one partner.
  - ➥ In addition to STDs, the reproductive system can be affected by other types of diseases.
- ☑ In males, the gland that supplies the liquid in which sperm swim can become swollen or develop tumors.
- ☑ In females, the tissues around cervix (the opening to the uterus) can develop cancer.
- ☑ Both of these problems can be cured if they are detected early Regular visits to a doctor are the best prevention.

Conceptual Example

Give short answer for the following Questions

48. What are the cause and effects of common STI's and how are they treated?

Table 4 . 4 Explanation

STI's	Cause	Treatment
1. Trichomoniasis	Protozoa	Anti - protozoa drugs
2. Gonorrhea	Bacteria	Antibiotics
3. Syphilis	Bacteria	Antibiotics
4. Candidiasis	Fungus	Anti - fungal
5. Chlamydial infection	Bacteria	Antibiotics
6. AIDS	Virus	Anti retroviral tnerapy (ART)

49. What are the male sex horomone and what are their function?

Explanation

Testoterone: The main hormones produced testes.

- ➥ required for sperm production
- ➥ Cause the development of the male secondary sexual characterstics

50. Which sexually transmitted infection are not curable?

Explanation

HIV/AIDS and genital herpes are caused by viruses and they are not curable.

End of unit Review Questions

Part I. Matching

A	B
1. FSH and LH	A) Birth canal
2. Prostate gland	B) Secrete fructose - rich fluid
3. Testis	C) Produces oestrogen and progestrone
4. Epididymis	D) Thin inner folds
5. Labia majora	E) Pituitary gland
6. Endometrium	F) Secretes semen compounds
7. Seminal vesicles	G) Conveys sperm out of body
8. Ovary	H) Produces testosterone and sperm
9. Oviduct	I) Usual site of fertilization
10. Vagina	J) Lining of uterusin folds
11. Urethra	K) Fat padded skin folds
12. Labia minora	L) Store sperm until ejaculation

Part II. Multiple Choice Items

Choose the best Answer from the given Alternatives.

13. Sexual reproduction ___
A) Requires formation of gametes by meiosis
B) Produces offspring identical in their traits
C) Occurs only in vertebrates.
D) All of the above.

14. The cervix is the entrance to the _____
A) Oviducts B) Vagina C) Uterus D) Scrotum

15. Semen contain secretion from the _____
A) Adrenal gland C) Pituitary gland
B) Prostate gland D) Corpus luteum.

16. Sperm in an epididymis passes next in to the: _____
A) Prostate gland C) Semineferous tubule
B) Urethra D) Vase deference.

17. Birth control pills deliver synthetic _____
A) Oestrogen and progestron C) Testosterone
B) LH and FSH D) Oxytocin and prostaglandins

18. Which one of the following is **not** the disadvantage of asexual reproduction:-
A) Little variation created
B) No mate is needed
C) No gamete is needed
D) All the food character sticks of the parents are on to the offsprings.

19. Moraly, teenagers are adult after they have reached puberty, when they are capable of have children:-
A) True B) False

20. The correct routes for the passage of sperm from it is site secretion to ejaculating it out.
A) Seminiferous tubule → vas deference → urethra → Epididymis

B) Seminiferous tubule → Epidymis → vas deference → urethra

C) Epididimis → seminiterous tube → vas deference → urethra

D) Seminiferous tubule → urethra → Epididimis → vas deference.

21. Which one of the following is **not** the characterstics of asexual reproduction?

A) The offspring are clone

B) egg & sperm are not fused

C) Meiosis takes place

D) The offspring are identical to one another and the parent.

22. Which one is not the advantages of asexual reproduce

A) No mate is needed

B) No ovary & testes needed

C) All the good characters of the parent passed on to the offsprings

D) The parent has little resistance to diseases.

Answer Key

Part I Supplementary

11. B
12. C
13. B
14. A
15. B
16. B
17. D
18. C
19. B

Part II Supplementary

26. B
27. C
28. D
29. C
30. B
31. C
32. D

End of unit Review Exercise

Part I Matching

1. E
2. F
3. H
4. L
5. K
6. J
7. B
8. C
9. I
10. A
11. G
12. D

Part II. Multiple choice item

13. A
14. C
15. B
16. D
17. A
18. A
19. B
20. B
21. C
22. D

UNIT 5

Human Health, Nutrition and Disease

5.1 What is Food ?

Food is any beneficial substances that is eaten, drunk, or other wise taken in to the body to sustain life.

The saying "you are what you eat" is true. substances in the food that you eat are called nutrients.

Nutrients are substances that the body requires for:

- Energy
- Growth
- Repair
- Maintainance
- Replace worn out tissues by the new one
- To protect the body from diseases.

☒ Food comes from plants, animals, fungus & algae that contains essential nutrients such as:

- Carbohydrates
- Proteins
- Lipids (fats and oil)
- Vitamines
- Minerals

The Importance of food in Living Things

Growth: Food is the sources of substance necessary for making new cells, tissues and organs.

- ➥ Food is assimilated and encorporated to becomes parts of the body which provided growth.

Energy: All cellular activities requires energy.

- ➥ Energy released from food by cellular reactions.
- ➥ Food is the sources of energy that fuel all the biological activities such as growth, reproduction, moving, running, Jumping, for transmission of nerve impulse etc.

Replacement of worn - out and damaged tissues food is required for making new cells, which is used to replace damaged cells of the body.

Protect from disease.

- ➥ Diseases may be caused by shortages of specific food group Theses are called deficiency diseases. our body requires these food group to protect the body from these diseases.
- ➥ Food also strengthen the immune system of the body.

Thus, food provide your body with what it needs to stay healthy.

5.2 Food and Nutrition

What is nutrition?

Nutrition is the process of taking in food and converting it in to energy and other vital nutrients required for life.

- ➥ The food that we eat keep us alive and provides the nourishment for growth, repair, and maintain of good health.

5.3 Nutrients

What is nutrients?

Nutrients are substances that the body requires for energy, growth, repair, and maintainance. our body gets nutrients from the foods that we eat to stay healthy.

There are six main groups of food need by the body. The six major groups of nutrients are:-

- ➥ Carbohydrates
- ➥ Proteins

- ➥ Lipids (fats & oil)
- ➥ Vitamines
- ➥ Minerals
- ➥ Water

Nutrients in food can be grouped as:-

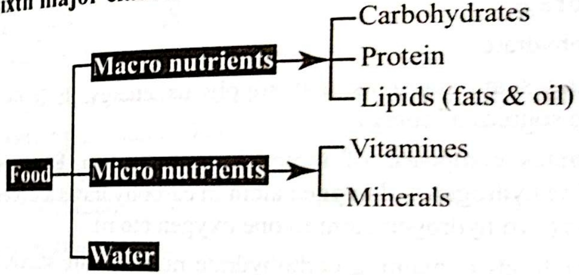
☑ **Macronutrients:-** are nutrients that are required by the body in large amount.

- ➥ These are carbohydrates, proteins & lipids

☑ **Micronutrients:-** are groups of nutrients that are needed by the body in very small amounts.

- ➥ These are vitamins and minerals

The sixth major class of food



☑ Water is important nutrients that make up Large percentage of a human body. water is life

☑ Vitamines are organic compounds, where as minerals are inorganic compounds.

☑ Vitamines and minerals are not energy sources of food.

☑ They regulate metabolic activities in the body and helps in the utilization of proteins, carbohydrates and lipids.

☑ Body structures and skeletons are made of minerals.

☑ **Nutrients:** are the chemicals substances in food that cells needs such as carbohydrates, proteains, lipids, vitam, minerals

☑ **Nutrition:** The study of nutrients and how your body uses them is called nutrition

☑ Nutrition is the long process that involves obtaining and utilizing food.

Nutrition is abroad process that involves the following steps:

- ☑ **Ingestion:-** taking food in to the mouth.
- ☑ **Digestion:** Changing large, complex and insoluble food particles in to their smaller, simpler and soluble food particles.
- ☑ **Absorption:** the process in which digested food particles are absorbed in to the blood stream.
- ☑ **Assimilation:** the process in which the absorbed food becomes encorporated and utilized by the body cells (for growth or energy soures).
- ☑ **Egestion:-** The removal of indigestible food materials celled fibres or roughage from the body in the form of faeces is called egestion.

1. Carbohydrate

What is carbohydrate

- ☑ Carbohydrates are nutrients that supply us energy. It is the most immediate sources of energy.
- ☑ Carbohydrates composed of three elements carbon, hydrogen and oxygen. The hydrogen and oxygen atom in carbohydrates are present in 2 : 1 ration (two hydrogen atom to one oxygen atom).
- ☑ Sources of foods containing carbohydrate nutrients are starch, fruits, sugar. Food stuffs that are rich in carbohydrate are cereals, honey, potatoes, spaghetti, candy, etc.
- ☑ The general formula of carbohydrate is:-

$(CH_2O_+)n$, Where $n > 3$

Functions of Carbohydrates

i. Sources of energy of the body

ii. The storage forms of food in plants and animals

- ➥ Starch - is the storage form of carbohydrates in plants
- ➥ Glycogen - is the storage form of carbohydrates in animals. It is made in the liver.
  - ➥ It is also called "animals starch"

iii. Structural Carbohydrates,

- ➥ Some carbohydrate are used to build structures includes:
- ➥ **Cellulose:-** cell wall of plants are made up of cellulose
- ➥ **Chitin:-** Cell wall of fungi are made up of a carbohydrate called chitin.

- ➥ **Peptidoglycane:-** Bacterial cell wall is made of peptidoglycan

Classification of Carbohydrates

Carbohydrates are classified in to three major classes based on the number of sugar units which they contain. These are:

- ➥ Monosaccharides
- ➥ Disaccharides
- ➥ Polysaccharides

☑ One sugar unit contain a minimum of three carbon atoms It is called triose $(C_3H_6O_3)$.

i. Monosaccharides

- ➥ It is the simplest carbohydrates
- ➥ It is called a simple sugar unit
- ➥ Sugar units are called saccharides.
- ➥ The most commonly known, simple and soluble form of sugar units.
- ➥ Example of monosaccharides are:
  - ➥ Glucose
  - ➥ Fructose
  - ➥ galactos
- ➥ They have the same molecular formula but have different structure. such kinds of molecules are called Isomers, $C_6H_{12}O_6$. They are called hexose sugar.
- ➥ All monosaccharides are soluble in water and have sweet taste.

ii. Disaccharides

- ➥ It is double sugar units
- ➥ Groups of carbohydrates which is composed of two sugar units.
- ➥ Disaccharides are formed by condensation reaction between two monosacuharides.
- ➥ When two monosaccharide units are joined up it produces (or losses) water as a by product is called condensation.
- ➥ Monosaccharide + Monosaccharide → disaccharide + Water
- ➥ The most commonly known example of disacchardes are:

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☑ **Sucrose :-** is found in sugar cane

- It is called cane - sugar
- Sucrose = glucose + fructose

☑ **Lactose:** is found in milk sugar

- It is called milk sugar
- Lactose = glucose + galactose

☑ **Maltose:** is found in germinating seed (cereals)

- It is called malt sugar
- Maltose = glucose + glucose

☑ Disaccharides: are sweet taste.

- It's molecular formula is $C_{12}H_{22}O_{11}$
- Disaccharides have the same molecular formula, but have different structure. They are called Isomers.
- They are soluble in water.

iii. Polysaccharide

☑ Polysacchrides are made up of many monosaccharide units. It has a complex sugar units.

☑ It contains long chains of monosaccharide units

☑ It is stable forms of carbohydrate which can not be directly used up by our body. In stead, it is stored in the body of living cell either as starch or glycogen.

☑ Polysaccharid are insouble in water and have no sweet taste.

☑ **Examples of polysaccharides:** - Starch - Peptidogycan - glycogen - Chitin - Cellulose

☑ It is a polymer which is composed of many monomer units of monosaccharides by condensation reaction.

☑ Starch is abundant in potatoes, bread, rice, maize, and other cereals.

Green plants make carbohydrates (glucose & starch) during photosynthesis. They combine CO_2 & H_2O in the presence of sunlight in to carbohydrate.

☑ One gram of glucose provide17KJ of energy.

☑ Undigestible carbohydrate provides dietary fiber that does not serve as a sources of energy.

☑ This indigestible part is aproduct of plants cell wall that consistes of cellulose

☑ This undigestible part of the diet is called fiber or roughage.

2. Lipid (Fats and oil)

Lipids are fats and oil which is groups of nutrients that provide high energy for the body: The energy provide from fats and oils are twice as much greatey than that of carbohydrates. It provides 35 to 45% calories in take. one gram of lipid gives 37 KJ of energy.

☑ Lipids composed of elements of carbon, hydrogen and oxygen like that of carbohydrates. But in lipids the ratio of hydrogen and oxygen is not the same to carbohydrates. In lipids there is little oxygen when compared to that of carbohydrates.

☑ Some lipids have quite large molecules, they are not polymers, and in many cases their molecules are relatively small. The feature that they all share is that are all made from fatty acids and alcohol (or glycerol).

☑ Lipids are varied group of compounds that includes:

☑ **Triglyceride:** formed from glycerol and three fatty acids.

☑ **Phospholipids:** formed from glycerol, two fatty acids and a phosphate group.

- Phospholipids are the basic constituents of cell membrane (plasma membrane).

☑ **Waxes:** formed from fatty acids and long chain alcohols.

☑ Birds feather are coated with waxes and also used make epidermes of plant leaves (called waxy cuticle).

Importance of Lipids

Generally lipids are important for:

- Storage of energy in the body (source of energy for the body)
- Structural components of cell membrane
- Insulation of layers under the skin ie. Thermal insulation
- Regulation of body temperature by maintaining body's heat in

animals living in cold climate, Example polar bear.

- Water proofing - the oil secreted by some animals on to their skin are lipids.

Triglycerides have Several functions:

☑ Energy sources of the body

- A molecule of triglyceride yields over twice as much energy as a molecule of glucose.

☑ Thermal insulation

- The cell of adipose tissues found under the skin of many animals contain large amounts of triglycerides, which gives good thermal insulation.

☑ Buoyancy

- Lipids are less dense than water (oil floats on water).
- Animals having large amounts of lipids reduces their density and can float on water and can swim or can cross rivers. called buoyancy.

☑ **Water proofing:** the oils secreted by some animals on to their skin are triglycerides which servers as a water proofing.

☑ Lipids are insoluble in water

☑ Lipids are soluble in organic solvents like alcohol, benzene, kerosine, etc.

☑ **Fats:-** Lipids are obtained from plants and animals.

☑ Lipids obtained from animals which is solid at room temperature and it is called fats (animal fats).

☑ **The major sources of animal fats are:**

- Meat
- Milk
- Butter
- Cheese
- Egg yolk

Vegetable oil:

☑ Lipids obtained from plants are called **Vegetable oil.** oil is liquid at room tempera.

☑ Oils can be obtained from fruits, seeds (Example sun flower seeds, *Guzosia abyssinica* (Nug), ground nut, etc are called vegetable oils.

- In human body, lipids are used to make fatty tissue, adipose tissue

under the skin form a layer used to reduce heat losses from the body called thermal insulation.

- Besides satisfying metabolic energy needs, dietary fat, also serve as a vehicle for the absorption of the fat - soluble vita mines (A,D,E,& K)

☑ Fats is a nutrient needed by human. A diet with high in fat contributes to obesity.

☑ Obesity is a major causes of:

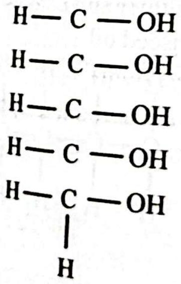
- Heart disease
- Blood pressure
- Diabetics

☑ The more highly saturated fats that obtained from animals are richer in energy. But it is not recomended for our dietary fats.

☑ The unsaturated fatty acids that contain double bond between carbon - carbon atoms, that obtained from vegetables called vegetable oils are relatively healther for our dietary because it contains less number of cholestrol.

i. **Glycerol:** is a three - carbon alcohol with each carbon bearing a hydroxyl (- OH) group. The three carbon from the back bone of fat molecule - to which three fatty acids are attached.

- Their molecular formula is $C_3 H_8 O_3$.



$$\begin{array}{l} H - C - OH \\ H - C - OH \\ H - C - OH \\ H - C - OH \\ H - C - OH \\ \quad\;\; | \\ \quad\;\; H \end{array}$$

Glycerol

i. **Fatty acids**

Fatty acids are composed of long hydrocarbon chains ending carboxy1 (-COOH) group.

Fatty acids vary in length:

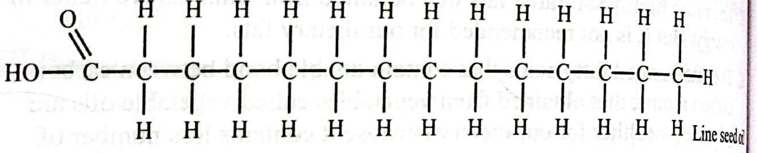
☑ The most composed groups of fatty acids are even numbered chains of 14 to 20 carbons.

Accordingly fatty acids are classified as:

- Saturated fatty acids
- Unsaturated fatty acids

☑ **Saturated fatty acids:** contain single bonds between carbon - carbon atoms and contain internal carbon atoms having two hydrogen side groups.

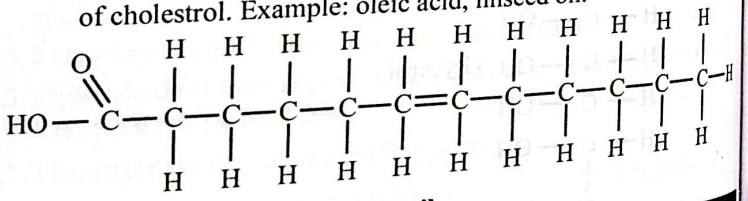
- Mostly fats are solid at room temperature.
- The more highly saturated fats are richer in energy, but they may upset the normal balance of fatty acide in the body.
- A situation may lead to heart disease & blood pressure.



Saturated fatty acid (palmitic acid)

☑ **Unsaturated Fatty Acids:** Contain double bonds between carbons that can replace some hydrogen atoms. They contain few number of hydrogen atom that saturated fatty acid.

- They are vegetable oils. They are healthier and contain less number of cholestrol. Example: oleic acid, linseed oil.



Linseed oil

Illustrative Examples

1. A shortage of vitamin D in the human diet is likely to result in:

A) Beriberi
B) Scurvy
C) rickets
D) Night blindness.

Answer: C

2. Which of the following foods has the highest energy content per gram of edible food material?

A) Tomato B) Ground nut C) Teff D) Potato

Answer: B

Explanation

Food Item	Energy Content in KJ/g
Tomato	0.9
Ground nut	24.0
Teff	14.2
Potatoes	16.9

3. Which of the following portions of a food is usable and digestible?

A) Rouphage B) Fibers C) Nutrients D) Bulk.

Explanation

Nutrients are substance that are usable digestible in out body. These includes carbohydrates., protein lipid, vitamines and minerals Reughage or fibers is undigestible food materials.

Answer: C

4. Loss of appetite and disease called Beriberi are caused by the deficiency of:-

A) Thiamin B) Niacin C) Riboflavin D) Pyridoxin

Explanation

Deficiency of vitamin B. (Thiamin) results in loss of appetite and nerve inflammation which leads to paralysis and mental illness. This condition is called Beriberi.

Answer: A

5. Which of the following deficienly diseases caused by the lack of vitamine B_2 - in diet?

A) Scurvy B) rickets C) Marasmus D) Pellagra

Explanation

Pellagra is adeficiency disease of vitamine B_2 which is characterized by diarthea, loss weight and mental disorder.

Answer: D

6. The sugar that is found milk is called ___

A) Maltose B) Sucrose C) Lactose D) glucose

Answer: C

Explanation

- Lactose is called milk - sugar
- Sucrose is called cane - sugar (sugar cane)
- Maltose is called malt - sugar (germinating cereals like barley, wheat)

7. Poor bone development is cased by the deficiency of

A) Retina
B) Riboflavin
C) Calciferol
D) Tocopherol

Explanation

Lack of vitamin D (calciferol) causes ricket which is charactrized by weak bone development.

Answer: C

8. If the following nutrients are oxidised the larget amounts of energy released is from the ____

A) Lipid
B) Protein
C) Carbohydrate
D) Starch

Explanation

Lipid (fats) contain twice as much energy than carbonhydrates. Thus, lipids contain 39KJ/g and glucose (Sugar) contain 17 KJ/g

Answer: D

9. The condensation reaction between two glucose molecules from:-

A) Maltose B) Starch C) Lactose D) Sucrose

Explanation

Maltose is a disaccharide form from the condensation reaction between two glucose molecules.

Answer: ___

10. Which of following is micronutrient

A) Carbohydrate
B) Protein
C) Minerals
D) Fats.

Explanation

Micronutrients are nutrients that our body requires them in very small amounts. E.g minerals & vitamines

Answer: C

11. Which of the following is incorrect about macronutrients:

A) Includes minerals and vitamines
B) Iron is an essential macronutrients
C) They are need in small amounts
D) Includes carbonhydrates, protein, and lipide

Explanation

Nutrients can be grouped in to macro - nutrients and micronutrients.

- Macro nutrients are nutrients required by body in large guantities. carbohydrate, proteni & lipid
- Micro nutrients are nutrients required by the body in small quantities. vitamines & mineraly

Answer: D

12. Which of the following nutrient serves as structural components of call membrane.

A) Vitamine B) Lipid C) Carbohydrate D) Minerals

Answer: B

13. Which one of the following is a milk sugar:-

A) Lactose B) Sucrose C) Maltose D) Starch

Explanation

Lactose is extracted from milk. It is called milk sugar sucrose is extracted from cane sugar and sweet potatoes. It is called cane sugar. Maltose is a sugar obtained from a germinating seeds like wheat, barely, maize. It is called malt sugar.

Answer: A

14. In saturated fatty acids

A) There are only singly bonds between carbon atoms.
B) There are more that double bonds between carbon atoms

C) There are only one double bond between carbon atoms

D) There are one triple bond between carbon atoms.

Explanation

Saturate fatty acids are only single bonds between carbon atoms.

Answer: A

3. Protein

Proteins are organic nutrients that are composed of elements of carbon, hydrogen, oxygen and nitrogen some proteins contain phosphorus and sulphur in addition to these elements.

- ➥ Amino acids are the building blocks of proteins
- ➥ There are 20 amino acids in nature that joined up to one another and form proteins.
- ➥ The bond between amino acids to form proteins are called peptide bond. The link between amino acids to form proteins by the loss of water are called condensation reaction.
- ➥ There are various types of proteins which differ from one another in number and sequence of amino acids which makes them.
- ➥ Some proteins are insoluble in water, while others are soluble water.
- ➥ Water insoluble proteins are structural proteins that are used to make connective tissues, tendons, bone matrix, hair, nails, hooves, horns & feathers.
- ➥ Water soluble proteins form antibodies, enzymes, and some hormones.
- ➥ The major sources of dietary proteins are from:
- ➥ **Animals proteins are:-** Meat, Eggs, Cheese, Fish, Milk, Chicken
- ➥ **Plants proteins are: beans** - Soya beans, Pea - Check pea - ground nut - bea are important protein sources.

Important functions of Proteins

☑ The structure of plasma membranes

- ➥ Cell membrane is made up of protein & lipids
- ➥ They are called lipoprotein and form bilayers of the phospholipids.

☑ The immune system

- ➥ Antibody and antigens are proteins

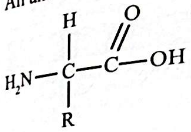
☑ All biological enzymes are proteins.

☑ Structure of chromosomes are proteins.

☑ Structural proteins such as tendons, connective tissues, bone matrix, hair, nail, hooves, claws are proteins.

The General Structures of amino acids

All amino acids contains:



$$H_2N-\underset{R}{\overset{H}{C}}-\overset{O}{\overset{\|}{C}}-OH$$

α - carbon = All molecules are built around α - carbon

- COOH = Carboxyl group (Functional group)

- NH_2 = amino group (Functional group)

- R - group

- Hydrogen atom

Table 5 . 1 **Sources and Function of Carbohydrates, Proteins & lipids, and their uses in the body**

Nutrients	Very Good Food Sources	Use in the Body
Carbo hydrates	Barely, wheat, potato, Bread, Honey, Sugary, candy, Foods.	Storage: sources of energy. ☑ Undigestible (roughage) provide dietary fibres
Lipids (Fat and oil)	Butter, Cheese, Animal fats, Vegetable oil	☑ Sources of energy (twice as muchas carbohydrates). ☑ Thermal Insulation aginst heat loss. ☑ Structure of cell membrane ☑ Insulation of nerve fibres.

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Protein	Meat, fish, Eggs, chicken milk, soya bean ground nut, pen, chick pea, bea, bean	☑ Growth, tissue repair ☑ Enzymes (All biological enzymes are proteins) ☑ Antibodies & some hormones ☑ Lipoprotein: structure of cell membran ☑ Hair, hooves, horn, nail claw ☑ Broken down to provide energy.

Conceptual Example :

15. Which type of lipid form the bilayer in cell membrane?

Explanation

Cell membrane is made up of lipoproteins. Which means proteins and lipids. Thus, cell membrane is a bilayer of phospholipid phospolipid is a lipid which priorily responsible for the formation of cell membrane.

16. Which type of bond holds amino acids together?

Explanation

Peptide bond is a bond that hold amino acids together formation of proteins.

17. Name the organic substance that is used in mammals for insulation.

Explanation

Lipids used in thermal insulation in mammals

18. What is the difference between saturated and unsaturated fatty acids?

Explanation

Saturated fatty acid:- Contain carbon - carbon single bond.

- Contain more number of hydrogen atoms
- It is mostly solids at room temperature.
- It is mostly found in animals called animal fats.

Unsaturated fatty acids:- Contain carbon - carbon double bond

- Contain less numbers of hydrogen atoms
- It is mostly liquid at room temperature
- It is called vegetable oil.
- It is more healthier for diet for human.

19. What is the building blocks of protein?

Explanation

- The building blocks of proteins are called amino acids
- Amino acids are linked with peptide bonds by the condensation reaction which loses water.

20. Mention the major functions of proteins

Explanation

The major functions of proteins are:

- Structure of plasma membrane.
- The immune system
- Formation of biological enzymes.
- Structure of chromosomes are called histones are proteins.
- Structural proteins such as tendons, connective tissues, bone matrix, hooves, hair, nail, etc are made up of proteins.

21. List some major dietary proteins sources from animals and plants?

Explanation

☑ Major sources of proteins from animals are:

- Meat, Milk, egg, fish chicken, cheese

☑ Major sources of proteins from plants are:

- Bea, pea, chick pea, soya beans, ground nut

22. Mention the two constituent (component) parts of lipids.

Explanation

Fatty acids and glycerol (alcohol) are the two component parts of lipids

23. List the major component parts of the general structure of amino acids?

Explanation

- Carboxylic group (COOH) and α - carbon atoms
- Amino group (NH_2) All are attached to the α - carbon atoms.
- R - group (R - radicals)
- H - atoms (Hydrogen atoms).

4. Minerals

Minerals are inorganic nutrients that required or needed the in small quantities called micro nutrients. The major mineral nutrients needed by human body are calcium, Iron, phosphorus, sulphur and Iodine. A disease called deficiency diseases may occurs due to lack of these minerals in the diet.

Table 5 . 2 Sources, Functions, and deficiency diseases of minerals.

Minerals	Uses in the body	Good Food sources	Deficiency Diseases
Calcium	☑ Build bone & teeth ☑ Muscle contraction & transmission of nerle impose ☑ Blood clotting ☑ Activation of certain enzym	☑ Cheese ☑ Milk ☑ Fish	☑ Ricket ☑ Weak (fragile) bone and teeth
Phosphorus	☑ Building bone & teeth ☑ Making of ATP, DNA, RNA and some protein.	☑ Milk ☑ Egg ☑ Cheese ☑ Meat ☑ Ground nut	☑ Poor growth of bone & teeth ☑ Growth retardation
Iron	☑ Making haemoglobin of the red blood cells ☑ Haemoglobin carries and trans port oxygen in the circulation	☑ Animal liver ☑ Legumes such as ☑ Meat ☑ Egg	☑ Anaemia (reducing number of haemoglo bin) ☑ Results weak ness
Sulphur	☑ Constituents of skin, nail, hair	☑ Legumes ☑ Fish : Egg ☑ Meat	
Iodine	☑ Make thyroid grands works properly ☑ Iodine - containing hormone called thyroxine produced by thyroid	☑ Iodized table salt ☑ Sea fish ☑ Vegetables ☑ Se foods	☑ Goiter (an enlargme nts of the thyroid gland)

5. Vitamines

Vitamines are organic nutrients that required by the body in smaller quantities called micronutrients.

- Plants can make these vitamines in their leaves.
- Human can obtain a sources of vitamines directly by eating plants or indirectly by eating herbivores animals.
- A disease called deficiency diseases may occurs due to their In sufficient amounts in the diet
- **Examples of vitamines:** Vitamine - A, vitamin - B_1 vitamin B_2, Vitamin - C, Vitamin - D, V_E, V_K, VB_{12}

☑ Vitamines are classified as: Water soluble and fat soluble

- Water soluble vitamin are V_B, V_C
- Fat soluble vitamins are vitamins - A, D, E & K

Table 5 . 3 Sources of vitamins, functions and Deficiency Diseases of vitamins

Types of vitamins	Uses in the Body	Good Sources of food	Deficiency Diseases
Vitamin - A (Retinol)	☑ To make cells of retina in the eyes	☑ Carrot ☑ Diary products ☑ liver, spinach ☑ Egg, milk	☑ Night blindness
Vitamin - B_1 (Thiamin)	☑ Used during cellular respiration	☑ Cereals ☑ Kideny, liver ☑ Yeast, milk	☑ Beriberi - loss of appetite & nerve imflamation
Vitamin - B_2 (Riboflavin)	☑ Formation co - enzymes	☑ liver, milk, yeast - extract, cheese, egg, and green vegetables	☑ Slow growth ☑ Eye disease ☑ Sore mouth
Vitamin - B_3 (Niacin)	Components Co - enzyme NADH, NADPH	☑ Milk, meat fresh vegetable liver, whole meal bread	Pellagra - characterized by diarrhea, weight loss, mental disorder.
Vitamin - C (Asscorbic acid)	☑ Sticks together cells lining surfaces (mouth) ☑ Carbohydrate absorption	☑ Citrus fruits ☑ Tomatoes ☑ Green leafy vegetable	☑ Scurvy - gumbleeding ☑ Wound don't heal ☑ Heart failure ☑ Anemia
Vitamin - D (Calciferol)	☑ Growth and strength of bone & teeth.	☑ Fish, liver Milk, dairy food ☑ Exposure to sunlight	☑ Ricket - week bone & teeth
Vitamin - E (Tocophorol)	Affects muscle & reproductive system	☑ Cereal oils ☑ Green vegetables ☑ Milk, Egg, Seeds ☑ Liver	☑ Sterilityin rats
Vitamin - K (Phoylo - guinione)	Used in blood clot tting by synthesising protrombin	☑ Cabbage ☑ Spinach	Prolonged blood - clotting time.

6. Water

Body fluids such as blood, lymph, and tissues fluids are mainly composed of water. The transportation of digested food in to the body cell and excretion of excess salt and urea out of the body is by water. Thus, water acts as a solvent and transport medium.

☑ Water is a constituents of living cells. and habitat for aquatic organisms.

☑ Water is auniversal solvents

☑ Hydrolysis reaction - large food molecules are hydroized by water.

☑ Removal of waste materials from the body.

☑ For osmoregulation; maintaining fluid and ionic balance of the body.

☑ Involves in transporting substance in the body such as food, hormones, antibodies, blood& waste products

☑ Regulating body temperature

☑ Life in our planet is impossible with out water

Roughage: is a bulk of undigested food materials.

- Human digestive system can not digest cellulose which is component parts of plant cell wall. There fore, most of vegetables (green pepers) remain undigested and it is called fibre or roughage.
- The colon which is part of large intestine absorbs water found in roughage which is used to facilitate digestive process and avoids constipation during removal of wastes (feaces).

Constipation: is feaces that stay too long in the large in testine and most of its water absorbed and becomes compact, hard and difficult to evacuate from the body.

Conceptual Examples

24. Why is water so important to life?

Explanation

Water is important to all life form in various ways These include:

- It is a medium for metabolic reaction the body
- It is auniversal solvent
- It plays a role in hydrolysis reaction which helps to break large sized substances in to smaller pieces water is a raw material for plants to properties photosynthesis

25. List out the major properties of water

Explanation

- Water is a universal solvent
- Water has high latent heat of vaporization
- Water is transparent
- Water has high surface tension
- It has high specific heat capacity
- Ice is less dense than liquid water.
- Water has the ideal viscosity for a transport medium.

26. Compare saturated and unsaturated fatty acids

Table 5 . 4

Saturated fatty acid	Unsaturated fatty acids
☑ Contain single bond between carbon - carbon atoms	☑ Contain double bond between carbon - carbon atoms
☑ They are solids at room temperature	☑ They are liquid at room temperature.
☑ Contain high level of cholestrol	☑ Contain less amounts of cholestrol.
☑ Contain more numbers of H - atoms	☑ Contain less numbers of H - atoms.

Supplementary - Exercises

Part I Matching #1

A	B
27. Proteins	A) Food rich in nutrients like potatoes and candy.
28. Carbohydrates	B) Contain building substances, growth and repair
29. Fats	C) It is found in animal source and solid at room temperature
30. Oils	D) It's source is vegetable and is liquid at room temperature
31. Minerals	E) It is organic & if it is low in the diet causes deficiency
32. Vitamins	F) Skeleton & teeth of the body is made of

5.4 Balanced Diet

What is balanced diet?

Balanced diet: is the diet that contains all of the nutrients in the correct amount and proportion is called balanced diet.

☑ A balanced diet gives us all the essential substances that we need in the right quantities

☑ A balanced diet must contain enough proportions of:-

- Carbohydrates and lipids (fats and oil) to meet our energy requirements Because they are important sources of energy
- Proteins - to provide the amino acdes to make new cells and to

produce tissues growth.

- Because protein is important for growth, building the body repair, bulds new cells & tissue development.
- Vitamines and minerals, plant fibres and water
- For normal functioning of the body and to become healthy by fighting diseases.

Thus, balanced diet is good for the healthy conditions of the body.

5.5 Determination of Balanced Diet

Balanced diet depends on the:-

- Age of the person
- Sex
- Conditions

Balanced diet depends on:

A) Age:- children have greater energy requirement than adult.

- They requires high amounts of proteins for growth and building the body. young children constantly developing and making new cells and tissues than adult. They need more minerals for making bones and bones and teeth than adult.
- Elderly people generally have lower energy and protein needs. How ever, they need to eat a balanced diet in order to stay healthy:-

B) Sex: Naturalcy, females have relatively higher fat content in their bodies than male.

- Fat in female body is stored in fat tissue, such as under the skin, Fatty tissues have a lower metabolic rate than muscular tissues.
- So women generally have a lower energy requirement than men.

☑ There fore, men should eat relatively more energy food than women should.

- Balance diet, is thus depends on sex.

C) Conditions:- conditions includes

- Pregnant woman (whether she is pregnant or nor)
- Work - conditions

- Health conditions
- Life style and activities

☑ Pregnant woman should eat more food for the development and growth of her body:

☑ Pregnant woman should get more minerals like calcium and phosphorus for the development of bone and teeth of her baby. she should get more proteins for her baby to make new cells, and tissues, for growth and development.

☑ She should get vitamines for the proper functions of the body the mineral iron is essential for pregnant woman.

☑ Some work conditions involves physical activities which requires more energy - rich foods than less - active jobs.

☑ People who are usually work physical exercises such as athlete, agricultural works, metal works, wood works, etc requires high energy - rich foods and high protein diets to build their muscles.

☑ Balanced diet is also related to the health conditions of the individual in that the immne system that fight against disease - causing pathogens requires proteins, vitamines and minerals Antibodies are proteins. So that patients requires more amounts of proteins, vitamines and mineral diets to recover from his illness.

There fore, the balanced diet that we take depends on the age, sex and the conditions in which the individual has situated.

5.6 Malnutrition

What is malnutrition?

Malnutrition is any king of abnormality which is related to feeding. It can be:

- Under nutrition
- Over nutrition

5.5.1 Under Nutrition

If the food eaten is too little than needed by the body, it is called under nutrition.

☑ Human body requires a balanced diet for normal functioning of the body. If food intake in human body is inadequate in carbohydrates, proteins, minerals or vitamines, it causes, a diseases called deficiency disease.

☑ A Deficiency diseases occurs when a person does not have enough amounts of one particular nutrient and suffers health problems as a result.

☑ Some of these deficiency diseases are:

- Kwashiorkor
- Marasmus
- Anaemia
- Ricket
- Scurvy
- Night blindness, etc.

Kwashiorkor

What is a kwashiorkor?

Kwashiorkor is a deficiency disease caused by lack of protein in the diet of human.

☑ In children it causes: discoloured hair

- Dry or flaky skin
- Thin legs and blotted belly
- Weakness
- Irritability

☑ It can be prevented by an intake of protein.

Marasmus

Marasmus is a deficiency disease caused by in adequate carbohydrates content in the human body. The term "marasmus" is a Greek word meaning decay.

☑ *Like kwashiorkor, the incidence of marasmus increases in children. Marasmus in children legs:*

- *Thin arm and legs*
- *Little muscle.*
- *Old - looking face.*
- *People with this disease are extremly thin with reduced fat & muscle tissues.*

- *Their skin is thin and hangs in folds.*

☑ Treatment involves delivery of an energy - rich balanced diet.

Diseases caused by Deficiency of vitamines and Minerals.

Anemia:- a deficiency disease caused by lack of a mineral iron is called anemia.

- It makes the haemoglobin of the red blood cells
- Heamoglobin carries and transport oxygen in the body circulation.
- If less heamoglobin, it results less oxygen in the body, less respiration rete, which produce less energy.

☑ Anemic person become weak, tired and irritable, due to the reduced number of haemoglobin

☑ It can be treated by using iron capsules and by consuming iron - rich food.

☑ Iron - rich foods are: animal liver, Meat, eggs, pea, bean, and legumes.

Ricket: a deficiency disease caused by lack of a mineral calcium is called ricket (calciferol)

- Calcium is used to make the endo - skeleton of human such as bone and teeth
- Calcium is important for growth and strength of bone and teeth.
- Lack of vitamin - D also causes a deficiency disease called ricket.
- Vitamine - D also help in the absorption of calcium and phosphorus through the gut wall. Food that provide vitamine - D are Egg - yolk, liver, Fish, milk and expossure to sun light.

Scurvy: Scurvy is a deficiency disease caused by lack of vitamin - C (ascorbic acid).

- Scurvy occurs when fibres in the connective tissue of and blood vessels do not form properly . This disease causes bleeding under the skin, particularly at the joints, bleeding gums and poor healing of wounds.
- Vitamin - C can not be stored in the body
- It is important to take it daily. Good sources of vitamin - C are: Orange, Lemon, grape fruit, tomatoes, fresh green vegetables.

Night blindness: is a deficiency disease caused by lake of vitamin - A (retionl) is called night blindess

- Vitamin A is used to make photoreceptor cells in the retina of the eyes.
- Lack of vitamin - A causes fail to see in the dim - light called night blindness.
- Good sources of vitamin - A are:
- Carrot, diary - products, liver, spinach, and egg.

5.5.2 Over Nutrition

What does over nutrition mean?

Eating too much food that needed by the body is called over nutrition.

☑ If the diet contain too much fat it causes diseases like coronary heart diseases.

☑ If fatty food builds up in the arteries, it reduces the diameter of the blood vessels which results in heart attack and also causes a disease called blood pressure.

☑ An other typical example of over nutrition is obesity.

☑ **Obesity:** is over weighted ness that is caused due to excessive consumption of food.

☑ Obesity can be controlled by:

- Eating less high energy foods (i.e low energy intake)
- Taking more exercises (i.e increase energy out put).
- Eating a balanced diet with a lower intake of energy.

☑ Malnutrition can also be characterized by eating wrong types of food only to satisfy our needs.

☑ These foods are the foods which are not considering the balanced diets which depending up on the age, sex and conditions of the individual person.

☑ There are two ways in which people can identify being obese:

- Being 20% above the recommended weight for her or his height.
- Having abody mass index (BMI) greates than 30.
- Body mass Index (BMI)

$$BMI = \frac{\text{Body Mass (Kg)}}{\text{Height} \times 2 \text{ (Meters } 5 \times 2)}$$

☑ A person with a BMI status below 18.5 is under weight,

☑ 18.5 - 24.9 normal weight

☑ Body mas Index 25.0 - 29.9 over weight

☑ 30.0 and above are obese

Conceptual Example

1. Calculate the BMI of person who has a body mass of 80 kgs and he is 1.85 meter tall.

   Is he/she likely to obese or not?

$$BMI = \frac{80 \text{ kgs}}{1.85\text{m} \times 2} = \frac{80}{3.7} = \mathbf{21.62}$$

- 21.62 between 18.5 and 24.9 which is a normal weight

2. Based on the example given above, calculate the BMI of a person who has abody mass of 95 kgs and heigh 178 centimeter tall. Is he likely to be obese or not?

Conceptual Examples

33. Mention the portions of food which is not digestible and vsable?

Explanation

- Roughages or fibres are undigestible food materials.
- They are not digestible and usable nutrients.
- Nutrients are substances that are usable and digestible in our body. These includes carbohydrates, lipids, vitamins and minerals.

34. Which nutrient causes poor bone and teeth development?

Explanation

Lack of vitamin - D (calciferol) and lack of a minerals calcium and phosphorus can causes deficiency disease called ricket.

- Rickets are characterized by weak bone and teeth developments

35. List the types of nutrients which provide higher energy content pergram.

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Explanation

From animal sources: beef, butter, fatty foods

From plants sources: ground nut, sunflower, lin olenic acid (linseeds), oleic acid (olive oil)

36. What are the root - causes of loss of appetite and the beriberi - deficiency disease?

Explanation

The deficiency of vitamin - B1 is called Thiamin, which causes the deficiency disease called beriberi and loss of appetites:

- Sources of food nutrient for vitamin - B1 are careals, animal liver and kideny, years and milk.

Supplementary Exercise

Part II Matching # 2

Match the following food nutrients with their deficiency diseases

A	B
37. Carbohydrates	A) Ricket
38. Proteins	B) Marasmus
39. Iodine	C) Goiter
40. Iron	D) Anemia
41. Calcium	E) Scurvy
42. Vitamin - D	F) Night blindness
43. Vitamin - B_1 (Thiamin)	G) Beriberi
44. Vitamin - A	H) Kwashiorkor
45. Vitamin - B_2	I) Fragile bone
46. Vitamin - C	J) Pellagra
47. Vitamin - B_3	K) Eye disease

5.7 Substance Abuse

What are drugs?

Adrug is any naturally or arfificially made chemical substances taken in to the body that change and affects chemical reactions in the body

What is substance abuse?

Substance abuse is using legal or illegal drugs or substances in a wrong way or in the excess amount.

☑ Some of the drugs are medical drugs taken legally to reduce a symptom and pain of diseases.

☑ These drugs supress pain, treat and cure diseases.

☑ In addition to medical substances, other legal substancs are present in many products such as:

- Tea, coffee and energy drinks (caffeine)
- Tobacco (nicotine)
- alcoholic drinks (alcohol).
- Chewing khat (chat) are used for recreational purposes.

Based on their effects on the central nervous system, drugs can be categized as stimulant drugs, sedatives and hypnotic drugs, pain killers, and hallucinogens.

Types of Drugs.

A) Stimulant drugs

- They are drugs that increase the activity of the nervous system.
- They reduce feelings of fatigue and sense of alertness temporarily. Stimulant drug can be:
- **Mild stimulant**: are drugs that have stimulating effect on the body at smaller scale. Example: caffeine, in tea, coffee & soft drink.
- **Heavy stimulants:** are drugs that stimulate the body at larger scale in unusual manner. Example cocaine, khatomine (khat)

B) Sedative drugs (Depressants) and Hypnotic drugs

The are drugs that slow dawn the normal or proper working or functioning of the nervous system. Example Alcoholic drinks, sleeping pills and tranquilizers (drugs used for the treatment of anxiety) are good examples sedatives drugs

C) Pain killers (Analgesis)

Analgesis or pain killers are drugs that dull our senses by affecting part of the nervous system that produces sense of pain. Example Aspirin, paracetamol etc.

D) Hallucinogens: are drugs that changes ate way you perceive thing. They produce distortion in one or all the five the senses. Example of such drugs:- LSD (Lysergic acid)

- Cannabis
- Hashish
- Marijuana
- Cocain
- Herion
- Ganja

They are also called Illegal drugs.

i. **Illegal Drugs:** are controlled drugs, are drugs, often used to bring behavioural change. The most commonly used illegal drugs are herion, cocain, LSD and cannabis (or Marijuana) These drugs may results in illusion, hallucination restlessness, seeing things that are not there and talking to people who are not there or died

ii. **Heroin** is made from poppies. It gives a feeling of power and contentment. But when this wears off, users become anxious and depressed. So they take more heroin to feel better, soon they feel they can not live with out it. such users become heroin addicts.

iii. **Cocaine** is made from the leaves of the coca bush. At first it gives a feeling of energy and strength. But after 20 minutes the user feel confused and anxious. They are unable to sleep for some time.

iv. **LCD (Lysergic acid diethylamide)**: is made from a fungus. user may see things around they changing in colour, shape & size or they may see things which are not there. This condition is called hallucination.

v. **Cannabis** is made from the dried leaves and flowers from the cannabis plant. **(Cannabis sativa)**. clearly. But they can be come confused.

II. Domestic Drugs

These drugs are commonly used in Ethiopia. The common domestic drugs are nicotine (tobacco), khatinone (chat), alcohol, caffeine (coffee & tea)

These drugs are known as socially accepted recreational purpose are also considered as legal drugs.

- legal drugs are also used for medicinal purpose.
- Pleasurable effects
- To help them relax
- To help them to concentrate, etc.

Even it there is no legal ground that prevent the use of drugs such as khat, alcohol and tobacco, it does not mean that they have adverse health effects.

For medicinal drugs, it is advisable and appropriate to used only a prescribed drugs. prescribed drug is a drug that is aided or recommended by a physician after proper diagnosis. It is important to take appropriate dossage and look at its expiry date. unless they may have adverse effects on health.

Drug Addiction

What is drug addiction

Drug addiction is a condition in which a person become dependent after using a drug a gain and a gain. Once a person gets addicted to a drug he/she can not manage to work and engaged in daily routine without using it. There fore, it is advisable not to use any form of drug by any means unless it is prescribed for you by a physician.

After getting addicted to a drug it is very difficult to stop its usage suddenly. This may cause unpleasant effects on the body. These unpleasant effects are called withdrawal symptoms.

The withdrawal symptoms include:

- Unwell feeling
- Aches and pains
- Shaking
- Sweating
- Headaches
- Fevers

- Nausea and depression, etc.

Some Examples of Drugs and Their Impacts

1. **Cigarette Smoking:** Cigarettes consistis of a powerful addictive chemicals called nicotine.

☑ It is made up of a plant called to bacco (Nicotiane tobacum).

☑ People used cigarate in order to stimulate their body or because they are addicted to it.

☑ The main components of cigarette or tobacco are:

- Tar
- Carbon monoxide
- Nicotine.

i. **Tar:-** A black sticky substance, collected in the lungs when the smoke cools

- The health effect of tar can be chronic bronchitis, lung cancer, etc.
- There are also different chemical compounds in tar such as carcinogen (produce cancer).
- Cancer start because of the changes in the epithelial cells of the lungs of the lungs that leads to the development of a mass of cells, known as tumour, it is this tumor results in cancer.

☑ Emphysema: Alveoli of the lungs have weakened wall because of the far which results coughing. coughing burst some alveoli

- Some not enough oxygen is supplied to the blood.
- Bronchioles collapse during expiration traping air in the alveoli, which often burst. This condition is called emphysema.

ii. **Carbon monoxide:-** is a poisohus gas found in cigarettes.

- The carbon monoxide combine with haemoglobin of the blood thus, no more oxygen is carried by the haemoglobin. Thus, no more oxygen is supplied to the heart muscle There fore, the heart beat increases to get more oxygen.
- Carbon monoxide also damage the lining of the blood vessels.
- There are also the risk of cardiovascular system

- This leads to heart disease and stroke.
- This is a major causes of death and disability in the world.

iii. **Nicotine:** nicotine has a stimulating effects: It is a compound that produce addicition.

- Nicotine from cigarettes is absorbed through the alveoli to enter the blood stream. Then go to the brain through blood circulation.
- In the brain nicotine activates the release of dopamine, the natural neurotransmitter substance associated with our experience of pleasure. Long - term exposure to nicotine have depressing the ability to experience pleasure. so more nicotine is needed and become addictive.

Nicotine also increases the heart rate and blood pressure because of narrowing the arterioles.

2. Drinking Alcohols

Alcohol absorbed through the stomach wall and small intestine quickly. liver cells break down the alcohol by the liver enzyme. Alcohol is depressant. It affects the brain by slowing down the transmission of nerve impulses. consuming larger quantities of alcohol leads to:

- Loss of coordination
- Loss of self - control
- Loss of Judgment and control movement
- Slow in reaction to the stimulus.

Why is doping such a big deal?

The most important reason doping is a big deal is the fact that they have harmful and long - lasting side effects, which include:

- Cardiovascular
- Central nervous system: insomnia, anxiousness depression, aggressive behaviour, suicide, headache, psychosis, tremor, dizziness, stroke.
- Respiratory
- Cancer.

Doping consequences:

1. Physical and mental health

2. Psychological health
3. Social consequences
4. Financial consequences
5. Legal consequences.
6. Sporting consequences

Illustrative Examples

48. When a person drinks coffee, it most likely make himself alert, This i because coffee contains

A) Stimulus
C) Sedatives
B) Hallucinogens
D) Pain

Explanation

Coffee & tea contain a mild stimulunt drug called caffeine. If makes the user alert.

Answer: A

49. Suppose a person tool unknown drug and becomes restless, confused and talk with his relatives who died five years ago. The drug he took most probably be:

A) Stimuland
C) Hallucinogen
B) Sedatives
D) Pain killer

Explanation

Hallucinogen is an illegal drug, that make a person confused, restless, illusion see things that could not exist in reality.

Answer: C

50. Extremely powerful stimulant drug that ends in depression is:

A) Cocaine
B) Caffeine
C) Nicotine
D) Khatinone

Explanation

Cocaine: Extremly powerful stimulant drug that ends in depression.

Caffiene: is mild stimulant found in coffee, tea and soft drink like coca.

Nicotine: is a stimulant found in cigarette

Khatinone: is a stimulant found in khat (chat).

Answer: A

51. Which is not legal recreational drug in Ethiopia

A) Khat
B) Coffee
C) Alcohol
D) Heroin

Explanation

khat, coffee, alcohol, cigarette are legal Ethiopian recreational drugs, but heroin is illegal drug.

Answer: D

52. A strong hallucinogen drug that is prepared in the laboratory is:-

A) LSD
B) Cocaine
C) Sedative
D) Depressant

Answer: A

53. The drugs are known to cause vivid walking dreams are:

A) Stimulant
C) Sedatives
B) Hallucinogen
D) Depressant

Explanation

Hallucinogen is a drug that makes people to see and feel things that do not exist in reality. It causes a vivid, illusion, fantasy walking.

Answer: B

54. Which of the following statement is correct about substance abuse? it

A) has not risk as long as it is taken in small dose
B) has no any adverse effects.
C) Increase the health of the brain
D) Is becoming more of health problem.

Explanation

- Has risks weather it is taken in a small or large doses.
- Has adverse effects on health, economic and psychological state of the user.

Answer: D

55. Unpleasant feeling up on sudden stopping of drug is:

A) Withdrawal symptoms
C) Substance abuse
B) Drug addiction
D) Headache

Explanation

Withdrawal symptom is unpleasant feeling caused due to stopping of drug after addiction.

Answer: A

56. A kind of drug that slows down the proper working of a nervous system is:

Explanation

Sedative is a drug that slows down the proper working of a nervous system.

5.8 Infectious and Non - infections Diseases

Disease is any form of abnormality that distorts its normal functioning.

5.8.1 Infectious Diseases

☑ The theory that disease can be caused by micro organisms is called the germ theory.

☑ Organisms that cause disease are called pathogens

☑ A disease that caused by a microorganisms infecting the body is called infections disease.

Types of Infectious Diseases

Infection diseases are dieases caused by pathogenic microorganisms. There difference is based on:

☑ The types of host that they infect
- Some infect human
- Some infect animals
- Some infect plants.

☑ Their mode of transmission
- By insects called vectors
- By contaminated food
- By contaminated water
- By contaminated air

☑ Types of disease - causing organisms
- Some are caused by virus
- Some are caused by bacteria
- Some are caused by fungi
- Some are caused by protozoa
- Some are caused by parasitic worms.

☑ The severity of the diseases and last - longer time
- TB, HIV - Severe and long - lasting diseases
- Measles, common cold - less - severer & short period diseases.

Table 5 . 5 Infectious diseases & Method of transmission

Pathogens	Infectious diseases	Method of Transmission
Bacteria	☑ TB	Droplet infection by coughing, sneezing, througair
	☑ Pneumonia	Droplet infection by coughing sneezing, through the air
	☑ Cholera	Drinking contaminated water
	☑ Typhoid	Drinking contaminated water
	☑ Most STI'S	Sexual inter course with an infected person
	Salmonellosis	Eating contaminated food
Protozoa	Malaria	Vector - female anaphilos mosquito
	Amoebic dysentry	Contaminated food and water
	Giardiasis	Contaminated water
	Sleeping sickness	Vector - Tsetse fly

Virus	AIDS	Sexual - Intercourse with infectedperson(Blood contact)
	Rabies	☑ Beat of infected animal ☑ droplet infection
	Common cold	☑ Droplet infection
	Measles	☑ Contact
Fungus	Candidiasis	Sexual Intercourse
	ring worm	Direct contact
	Athlet's foods	Direct contact

Transmission of Infectious Diseases

How are diseases - causing micro organisms Transmitted?

Understanding of the biology of the pathogen and its mode of transmission is essential to control and prevent the disease.

Different infections diseases have different

Mode of transmission

1. **Human being:** some infection diseases such as:
   - Sexually transmitted infections
   - Common cold
   - diphtheria
   - Tuber closis (TB)
   - Measles, etc are transmitted from one person to another with direct contact with the patient.
2. **Water and Food:** some infectious diseases are transmitted by drinking and eating contaminated water and food (food or water containing disease - causing organisms) such as Typhoid (food born) and amoeba, cholera, giardia and salmonellosis (water born) diseases.
3. **Air:** Air - born diseases such as tuberculosis, pneumonia, common cold etc are infectious diseases transmitted through air called air - borne infections disease.
4. **Vectors:** Vectors are an animals that transmit disease - causing infectious diseases Example: female and philos mosquito beats transmit malarial

disease.

- By the beat of tsetse fly - transmit trypanosomiasis (sleeping sickness).
- Chicken transmits salmonell infection.

5. Soil: Infectious disease such as tetanus, Ascaris egg are transmitted from soil.
6. Contaminated objects: Contact infection such as HIV/AIDS and trachoma.

Method of Transmission of Infectious diseases are through:

☑ **Droplet Infection:** Diseases affecting the air - ways of the lungs - are respiratory disease

- Infectious diseases are carried in tiny droplets through the air - by cough or sneezes. Eg. Pneumonia, flu, TB, common cold
- **By drinking and eating contaminated water and food:** Cholera, typhoid by salmonella by water, and food.
- **Direct contact:** contact of infected skin diseases from infected person. Example: ring worm, Athlete's food
- **Blood to blood contact:** AIDS and Hepatitis B
- **Sexual intercoarse:-** Syphilis, Gonorrhoea, AIDS, candidiasis, chancroid infectious diseases are transmitted.
- **Animal vectors:** Malaria, trypanosomiasis (or sleeping sickness) transmitted when the insects beats.

Prevention and Control Methods of Infectious Diseases

How is preventing and controling of infectious diseases?

Control method is breaking of transmission cycles by removing the conditions that favor the spread of the disease - causing organisms. The control methods are:

1. **Vaccination:** is a major control measure for many infectious diseases.
   - This is by giving a weakened or dead form of the micro organisms itself so as to make the body to defend against the disease - causing organisms (or pathogenes).
2. **Personal hygiene:** protect the entrance of disease causing organisms in to our body.

3. Hygienic food preparation, boiling/cooking food and water to kill the pathogens.
4. Proper waste disposal
5. Covere bins and collected dirts at regular intervals.
6. **Sewage treatment:** toilet waste has to be disposed properly
    - Water pipe should be arranged far from water drainage.
    - Water born infectious diseases such as cholera and glardia are transmitted through the contaminated drinking water by feaces and sewage.

HIV/AIDS

What is HIV/AIDS?

HIV - is human immunodeficiency virus infection.

AIDS - is Acquired immunodeficiency syndrom.

AIDS is a disease caused by HIV infection. People who have HIV - infection in their body are called HIV - positive or HIV - carriers. They show no symptom of the disease for several years after infections.

HIV - replicates in humane T - lymphocyter cells. During its replication HIV destroys these T - lymphocyte cells. As are sult T - lympocytes decreased which leads to declining disease - resistance ability of the body and AIDS occured.

The CD4 T - lymphocytes (or T - helper calls) are the immune system of human. AIDS is the results of opportunistic diseases like pneumonia, TB, cancers, weight loss, diarrhoea, etc.

Transmission of HIV

HIV can be passed from one person to another by direct exchange of body fluids such as:

- By sexual inter course, fluid transfer from one person to another.
- By blood - transfusion, during blood donation
- By sharing needles in intra vienous drug users.
- Mother to featus in pregnant mother.
- Mother to infant in breast - milk.

Prevention and Control of HIV/AIDS

☒ There is No cure drug for HIV/AIDS, no vaccine for HIV There fore, it is important to prevent this disease by the following methods:

- All blood should be tested before transfusion in activity of blood donation.
- Needle used by intraveinous should be sterile and used only once.
- Avoid multiple sexual activities (multiple sexual partners)
- Use condom properly to prevent the infection.

Tuberculosis (TB)

TB is an infection disease caused by a bacterium called **Mycobacterium tuberculosis** These bacterium live in cell especialy in lungs.

Symptoms:- Cough

- Chest pain
- Breathing difficulties
- Fever
- Sweating
- Weight loss, etc.

Transmission:- It is through air - born droplets

- It is through cough or sneezing
- Transmission occurs when people inhale the bacteria through droplets in the air. These happen rapidly where people are living in croweded conditions, and crowed. public transportations.
- Another transmission is consoming uncooked meat and unboiled milk. This type of transmssion nainly occurs for the TB transmits from infected animals.

Prevention and control of TB

Vaccine: The only vaccine available for TB is the BCG vaccine.

- BCG vaccine protect 70 - 80%
- BCG vaccine is given during early child or infant stage. The effectiveness decreases with in old age.

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☑ TB is relating to reduced immunity of the body.

☑ HIV reduces the immune system of the body. Thus, HIV - infection person can easily be volnerable to opportunistic infection such as TB.

☑ Increase the standard of living of people who are living with HIV and treating HIV infected people help to reduce incidence of TB.

Malaria

Malaria is an infectious disease caused by a protozoa called plasmodium. It is transmitted by the insect beat of the female Anopheles mosquito species. It is a vector.

☑ It is common in tropical and sub tropical region.

☑ This region is a con for table humin area for mosquito breeding.

☑ The female anaphilos moaquiton feed on human blood.

☑ Malaria transmitted from infected person to ahealthy person by the beat of parasitized female anaphilos mosquito.

☑ Symptoms: fever, chills, sweats. & headache

- It makes people unable to work.

Control and Prevention:

☑ Avoid the beat of mosquitoes by using net over beds, fixing screens on windows, using mosquito coils and mosquito repellants.

☑ Minimizing opportunities of mosquito bread by draining swamps, stagnant water or cover water tanks.

☑ Killing adult mosquitoes by insecticides

☑ Biological control method by using fish that feed on mosquito larvae.

Corona Virus - 2019

(COVID -19)

☑ COVID - 19 is a disease caused by a virus to the family called corona viridae. The virus is called RNA - Virus.

Symptom: Cough

- Chills
- Sore throat
- Chest pain
- breathing difficulties.

- Loss of taste or smell
- fever, headache and sweating
- Tiredness

Transmission: Spread through the droplets and viral particles released in to the air, when an infected person talks, breathes, laughs, sings, coughs and sneezes.

- These droplets can be inhaled in to the mouth, nose, or eyes of a person.
- It can also be spread if a person touches a surface with the virus on it and then touches his mouth, nose or eyes.

Prevention and Control of COVID - 19

☑ To prevent and control covid - 19, follow instructions or follow the protocolls of COVID - 19 : These methods are:

i. Keep your self at least 2 meters of distance between infected person or people out side.

ii. avoid crowds and have poor ventilation

iii. Wash your hands often with soap and water for at least 20 seconds, or use sand sanitizer that contain at least 60% alcohol.

iv. Wear a mask in public places.

v. Cover your mouth and nose with your elbow or a tissue when you cough or sneeze

vi. Throw away used tissue. Wash your hands right away.

vii. Avoid touching your eyes, nose and mouth.

viii. Clean and disinfect surfaces you often touch on a daily basis.

Vaccine: Currently vaccines available by different countries for COVID - 19.

- These vaccines are Astrazeneca's, AZD 1222, BioNTech's, BNT 162, etc.
- Currently many people receives these vaccines.

COVID - 19 is a pandemic infectious disease.

Pandemic: is an epidemic that spread far more widely through out the whole world it affects a huge number of people.

Conceptual Examples

57. Name the micro organisms that cause disease to human, animals and other organisms.

Explanation

Pathogens are micro organisms that causes infectious diseases to human, animals and other organisms.

58. Explain the mode of transmissions of infectious diseases.

Explanations

The mode of transmission of infectious diseases are different.

Vector - disease like malaria is transmited by the beat of mes the vector called female anaphilos mosquito

- Sleeping sickness transmited by beat of tsetsefly.

Eating contaminated food - salmonellsis, a mooebbic dysentry are transmitted by eating contamineted food.

Drinking contaminated water - giardiasis, cholera, thyphoid.

Air borne - TB, covid - 19, common cold are transmitted by droplet infection through air.

59. List out some covid - 19, protocols or instructions to prevent and control the disease.

Explanation

- Keep your self at least 2 metersdistance from people.
- Wash your hands with water and soap
- Use sanitizers containing at least 60% alcohol
- Use mask in puplic places.

60. Explain about an infectious disease that attack the immune system of the body.

Explanation

HIV is an infectious disease that attack the immune system of the body such as T - helper cells, T - lymphocytes CD4 as a result declining disease resistance ability of the body and opportunistic infection such as pneumonia, TB, fungal diseases occurs.

61. Explain the main ways of transmission of HIV

Explanation

- Sexual inter course with an infected person is the main transmission way of HIV.
- Blood - transmission sharing needles, and mother to feotus are transmission ways of HIV.

Supplementary Exercises

Part III. Say True if the statement is correct and false if the statement is incorrect

62. Tuber culosis (TB) is transmitted through air - boarn - droplets through coughing and sneezing .

63. There is no vaccine available for adults to prevent TB (Tuberculosis).

64. By controlling mosquitoes breeding areas, by draining stagnant water ,swamps, and cover water tanks, posseblycan. minimize malarial infection.

65. Covid - 19 could not transmitted by touching surfaces with the virus on it and then by touching his eyes, nose or mouth.

Part IV Supplementary Exercise

Table 5 . 6 Fill in the table to show the cause, method of transmission, control method of the infectious diseases

Diseases	Cause	Method of transmission	Control methods
Malaria	Plasmodium protozoa	65	☑ Draining stagnant water where mosquito breeds ☑ Insecticide & net over bed.
Typhoid fever	66	Eating contaminated food	Washing hand before meal & after toilet

Giardiasis	Protozoa **Giardia lambella**	67	☑ Practic good hygienic water and food.
AIDS	68	Blood & fluid contact	69
Amoebiasis	Entamoeba histolytica	70	☑ Cook food & boil drink water ☑ Use vinegar for vegetable foods

5.8.2 NOn - Infectious Diseases

These are diseases caused by malnutrition, chemical effect, inherited or genetic factors, etc

Table 5 . 7 Types and causes of Non - Infectious Disease.

Types of Non - Infectious diseases	**Causes**	**Example of Diseases occur**
Human - Induced diseases	☑ Person's life style ☑ Working condition	☑ Heart disease ☑ Cancer ☑ Obesity ☑ Fibrosis ☑ Diabetes ☑ Hypertension, etc
Degenerative disease	☑ Tissue deterioration due to aging	☑ Deafness ☑ Loss of accurate sight ☑ Arthritis & artherosclerosis
Deficiency disease	☑ Nutrient shortage in diet	☑ Kwashiorkor ☑ Scurvary ☑ Ricket ☑ Goiter ☑ Anemia, etc
Genetic disease	Mutation	☑ Sickle cell anemia ☑ Hypertension ☑ Haemophilia ☑ Diabetes
Social Disease	Social activities	☑ Alcoholism ☑ Drug addiction ☑ Depression ☑ Isolation, etc.
Functional diseases	Organ or systems malfunction	☑ Kidney failurity ☑ Heart failurity ☑ Chronic fatigue syndrom ☑ Large Intestine disease.

5.9 Renowned Nutritionists In Ethiopia

Nutritionist are researchers or scientists who study nutrition.

Unit End Review Questions with Explanatory Note

1. Explain the difference between nutrition and nutrients

Explanation

Nutrition: is the process of taking in food and converting it in to energy and other vital nutrients required for life is called nutrition.

Nutrients: chemical substance found in food and used by the human body for growth or to provide energy.

Example: protein, carbohydrates, lipids, vitamines and minerals.

2. List examples of food that belongs to fructose, sucrose and starch.

Frut

Explanation

Foods belongs to:

- Fructose some times called fruit sugar.
- Fructose is naturaly occuring sugar found primarly in fruits.

- Sucrose is called table sugar is found naturally in sugar cane and sugar beet
- Starch is found in potato, bread, pasta, macaroni, rice and cereal foods, etc.

3. What is the sources of minerals and vitamins?

Explanation

The sources of minerals and vitamines:

Vitamins: any fruits and vegetables are it's sources

Minerals: Milk, cheese, (for calcium)

- red meat, liver kidney, eggs, ground nuts Tikur teff (for iron), Iodized salt fish (for iodine) etc.

4. Some times a person can eat alot of food, can this cause malnutrition?

Explanation

Yes it causes malnutrition because of excessive feeding. This leads to obesity.

5. What is the plame of the pathogenic micro organism that causes the infectious disease called TB?

Explanation

TB (Tuber culosis) is an infectious disease caused by a bacterium called mycobacterium tuberculosis.

6. Name the deficiency disease caused by the shortage of vitamin D?

Explanation

Ricket is a deficiency disease caused by the shortage of vitamin D and calcium - mineral.

7. What is the main sources of iron, calcium and Iodine minerals?

Explanation

Iron: Animal liver, meat, egg and legumes are the main sources of food of the mineral iron.

Calcium: Cheese, milk and fish are the main sources of food containing calcium.

Iodine: Iodized table salt, sea fish are iodine - rich foods.

8. Name the deficiency disease caused by inadeguate carbohydrate content in the body.

Explanation

Marasmus The incidence of marasmus in creases in children, like kwashiorkor.

Supplementary Exercises

Part IV Matching #3 Match non - infectious diseases with their causes or their examples

A	B
9. Genetic diseases	A) Hemophilia and sickle call anemia
10. Degenerative disease	B) Nutrient shortage in the diet
11. Social disease	C) Person's life style and the working condition
12. Deficiency disease	D) Tissue deterioration due to aging
13. Human - induced	E) Organ or system malfunction
14. Functional disease	F) Drug addiction and depression

Unit End Review Questions with explanatory Note

15. What is the causes of malarial infectious diseases?

Explanation

The protozoa called plasmodium is a causative - agent of the malaraial disease.

16. What is vector?

Explanation

Vector is an animal that transmit disease - causing pathogen from an infected person to the health one. example. The female anaphiles mosquito is a vector for malarial disease

17. How can we prevent malaria?

Explanation

Preventing method of malaria are:

- Drain the stagnant water where mosquito breads
- Use net over bed
- Use insect repellant
- Use pesticid

End of unit Review Exercises

Part I. Choose the correct Answer for the Following Questions

18. Which of the following nutrient provide more energy?
A) Protein
B) Carbon hydrate
C) lipids
D) Vitamins

19. Which of the following is **not** belong to deficiency diseases
A) Kwashiorkor
B) Diabetes
C) Marasmus
D) Scurvy

20. Which of the following diet is composed of carbon, hydrogen, oxygen and nitrogen?
A) Carbohydrate
B) Protein
C) Lipid
D) Vitamins

21. Which of the following minerals are used to synthesize the haemoglobin of red blood cells?
A) Iodin
B) Calcium
C) Iron
D) Phosphorus

22. Which of the following groups of people needs high amount of balanced diet?
A) Althletes
B) Pregnant woman
C) Children
D) All

23. Which of the following is **not** the results of obesity?
A) heart disease
B) high blood pressure
C) diabetics
D) Marasmus

24. Substance abuse is ______
A) Using legal drugs in the wrong way.
B) Using illegal drugs in the wrong way.
C) Using legal or illegal drugs for medical purpose

D) A and B

25. What are the chemicals found in tobacco?
A) Carbon monoxide
B) Nicotine
C) Tar
D) All

26. What type of drug is alcohol?
A) Depressant
B) Stimulunt
C) Activator
D) All

27. What is the stimulunt or psychoactive component found in cannabis:-
A) Tetrahdrocanabinol
B) Cathi none
C) Tar
D) Nicotin

28. Which of the following human disease can be prevented by taking proper diet?
A) Genetic proper
B) Social disease
C) Deficiency disease
D) Degenerative disease

29. Which of the following practices does not normally transmit HIV?
A) Sexual intercourse
B) Sharing injection needle
C) Shaking hands
D) Blood transfusion

30. What one of the frequent causative agents of food poisoning?
A) Bacteria
B) Protozoa
C) Virus
D) Worms

31. Which one of the following is a human genetic disease?
A) Kwashiorkor
B) Hacmophilia
C) Cholera
D) Arthritis

32. A micro organism that causes a disease called Athlet's foot is:-
A) bacteria
B) Fungi
C) Protozoe
D) Viruses

33. Which one of the following is an infectious disease?
A) Arthritis
B) Kwashiorkor
C) depression
D) Pneumonia

34. What is the total mass of hyphae in mucor fungi?
A) Sporangium
B) Mycellium
C) Hyphae
D) Rhizoid

35. Rod - shaped bacteria are called:-
A) Spirilla
B) Bacilli
C) Cocci
D) None

36. What is the main mode of transmission of disease such as cholera and

giardiasis?

A) Sexual inter course
C) Drinking contaminated disease
B) Blood - to - blood transfusion
D) Insect vector

37. The process of removing fibres or roughage from the body in the form of faeces is called ____

A) Ingestion B) digestion C) Egestion D) Assimilation

38. One of the following is not the function of carbohydrates?

A) Sources of energy for the body cell
B) Information sources
C) Storage of food in plants & animals
D) Structural carbohydrates

39. One of the following is **not** amonosaccheride ____

A) glucose B) Sucrose C) fructose D) galactose

40. One of the following is **not** a poly saccharide ____

A) Chitin B) Starch C) Maltose D) Cellulose

41. When two monosaccharide units are joined up to form disaccharides water is lost. This process is called ____

A) Hydrolysis
C) Crystalization
B) Condensation reaction
D) double sugar units.

42. A sugar found in germination seeds (cereals) is called ____

A) Lactos B) galactose C) Maltose D) Sucrose

43. One of the following is not the function of lipid:

A) Sources of energy
B) Component part of cell membrane
C) Water - proofing
D) Formation of enzyme

44. The condition in which the alveoli of the lung be come weakened wall and bust during coughing as a results of accumulation cigarette tar is called:

A) Emphysema B) cancer C) Tumer D) Cardiovascular

Part II Fill in the blanks Spaces for the Following Questions

45. The theory which states that all infectious diseases are caused by micro organisms is ____

46. A drug that makes people to see and feel things that do not exist in reality is know as ____

47. A drug that largely affect the liver when used is ____

48. Highly powerful stimulant during that causes depression at the end is ____

49. An infectious disease that spread out widely through out the world and infect many people are called ____

50. The sugar which is found in milk is called ____

51. Proteins are made up of elements of ____, ____, ____ and ____

52. The storage forms of carbohydrates in plant is ____ while the storage form in animals is called ____

53. The power ful addictive chemical which is found in cigarette smoke is called ____

54. The chemical in cigarette which attack the haemoglobin which causes the shortage of oxygen to oxidize the food to release energy is called____

55. Simple sugars joined to form double sugar by the reaction known as ____

56. ____ is the right type and precise amount of food required for the healthy state of the body.

57. ____ is the process of obtaining and utilizing food.

58. The cell wall of fungi and bacteria are made up of a complex carbohydrates respectively are called ____ and ____.

Answer key

Answer key for Supplementary Exercise

Part I. Matching # 1

27. B 28. A 29. C 30. D 31. F 32. E

Part II. Matching # 2

37. B 38. H 39. C 40. D 41. A

42. I 43. G 44. F 45. K 46. E 47. J

Part III Answer for True/False Item

Answer for

62. True
63. True
64. True
65. False

Part IV Fill in the blanks spaces in the table

65. By the beat of female anaphilos mosquito
66. Salmonella typhi
67. By eating contaminated food and water
68. HIV
69. Avoid casual sex
    Avoid blood contact
    Use condom
70. Contaminated food and water

Answer key for End of unit Review Exercise

Part IV Matching #3

9. A
10. D
11. F
12. B
13. C
14. E

Part I. Multiple choice

18. C
19. B
20. B
21. C
22. D
23. D
24. D
25. B
26. A
27. A
28. C
29. C
30. A
31. B
32. B
33. D
34. B
35. B
36. C
37. C
38. B
39. B
40. C
41. B
42. C
43. D
44. A

Part II. Fill in the blanks spaces.

45. Germ theory
46. Hallucinogen
47. Alcohol
48. Cocaine
49. Pandemic disease
50. Lactose
51. C,H,O & N
52. Starch/glycogen
53. Nicotine
54. Carbonmonoxide
55. Condensation
56. Balanced diet
57. Nutrition
58. Chitin and peptidoglycane.

UNIT 6

ECOLOGY

6.1 Ecology

What is ecology?

Ecology is a branches of biology that studies about the interaction between organisms among themselves and with their environment. Ecology came from two Greek words, oikos : house, logy = study).

- Ecology is a science that studies about the interaction between organisms among themselves and with their environment.

Habitate: a place where living organisms are living

Environment: is sum - total of all the living (Biotic) and non - living) (biotic) components in a given habitate.

Ecologist: The scientist who studies ecology is known as ecologist.

✓ Natural history: the study of plants and animals, where they lives, what they eat, and what eats them is called natural history.

✓ It tells about the health of the world we live in researches made by Ecologists.

There are two types of researches are made by ecologists.

These are:

A) **Qualitative research:** is gathering information by observing organisms and their environment.

Example

Informations gathered about arboreal animals (tree animals) is by observing the physical structure and appearance of the organism it's environment.

B) Quantitative research: is gathering quantitative information (or data) by measurements and doing experiments.

Example

The acidity of the soil is tested or gather information by measuring the PH range of the soil.

- Ecologist study organisms both in the laboratory and in the field where they live.

Ecological Level

The interaction of organisms among themselves and with their environment is shown by the relation ship called ecological level of organization at the organismic level.

The following relation ship shows based on an increasing level of their complexity.

Organisms → Population → community → Ecosystem → Biome → Biosphere (or Ecosphere)

Organisms: is an individual plant, an individual animal or individual micro organism or their component is called organism.

Population: is a groups of organisms of the same species, occuring (or living together) in the same habitat (or place) at the same time is called population

- To explain population the three important terms has to be occured.

These are:- The same species

- The same habitat (or place)
- The same time

Example

- Maize (or crop) occur in a given plot of land at the same harvesting plot of land at the same harvesting season is called population
- Human population living in a given village or town at the same contemporary
- Cattle population of the same species occurs in a graing field at the same time is called population.

Community: is a group of organisms of different population living together in the same habitat.

- A given community many contain different different species of organisms living together in the same habitat.
- This includes different species of animals, birds, grasses, trees, insects, etc.

Ecosystem (biotic): The interaction of living organisms among themselves and with their non - living environment (biotic) is called ecosystem.

- Ecosystem contain both living organisms (biotic) and non - living matter (abiotic).
- An ecosystem is a self - supporting.
- The pond, lake, ocean, forest, sea, desert, tundra etc - are major ecosystem of the world.

✓ The pond is the smallest ecosystem of the world, where as equatorial rain forest regions are the largest ecosystem of the world.

Lakes and ponds are clear examples of the ecosystem. sunlight, water, and minerals allow the plants to grow and support animal life. The recycling of materials from the dead organic matter maintains the supply of nutrients. So a population of a carp forms parts of the animal community living in a habitat is called a lake. A communities in this habitat, together with their watery environment, make up a self - supporting ecosystem.

The whole of the parts of the earth's surface which contain living organisms is called biosphere (or ecosphere). The whole system depends on a constant input of energy from the sun and recycling of the material elements such as nitrogen, carbon, sulfur phosphorus, etc.

Types of Ecosystem

An ecosystem is made of all different population in a biological community and the community a biotic factors.

There are major kinds of ecosystem:

- Terrestrial ecosystem
- Aquatic ecosystem

- ✓ **Terrestrial ecosystem:** consisting of an area of land
  - ➥ Example forest, fields, rotting log.
- ✓ **Aquatic ecosystem:** subdivided in to two main types:
  - ➥ Marine ecosystem
  - ➥ Fresh water ecosystem.
- ✓ Fresh water ecosystem:- consisting of a river, lake & pond
  - ➥ less or no salt contents.
- ✓ Marine ecosystem:- consisting of salt water like sea and ocean.

6.2 Biotic and A Biotic Components

A biotic factors

What are a biotic factors?

A biotic factors are non - living components of the ecosystem (or the physical factors) that influence the distributions and abundance of organisms (or biotic) in their environment.

The major abiotic factors includes: water, sunlight, air, soil, temperature, humidity, rain fall, topography of the land energy, nutrients, salinity, etc.

Table 6 . 1 Shows the Influences of Abiotic factors on the Distribution & abundance of Biotic components in the ecosystem.

Abiotic Factors	How it Influences (affects) the Biotic components
Water	✓ It serves as a habitat for aquatic organisms ✓ It is a raw material for photosynthesis in plants ✓ It is a sources of drinking. ✓ It is about 66% of the living body is made up of water
Sun light	✓ It is the primary sources of energy for all forms of life. ✓ All green plants, algae and some photosynthetic micro organisms use light for a sources of energy for photosynthesis to make organic substance (food). ✓ The internsity of light is important a biotic factor
Temperature	✓ Important abiotic factors because of its effects on metabolism (enzyme activities). ✓ Most organisms function best with in a specific range of environmental temperatures.
Soil	✓ Nature of the soil whether it is fertile or not, the PH - of soil (acidity and alkalinity)
A biotic factors	✓ Effects or Influences on the biotic components
Air	✓ The concentration of oxygen and carbon dioxide is important a biotic factors.
Rain fall	✓ The intensity and distribution of rain fall affects the distribution and abundance of living organisms.
Inorganic nutrients such as nitrogen, phosphorus and sulfur	✓ Plants obtain these nutrients in the form of compounds from the soil. ✓ It is important mineral ions for living organisms. It's soil content determine the growth and distribution of organisms.
Humidity	✓ is the concentration of water vapour (moisture) in the air. The higher the water vapour in the air, the hight the humidity in the air. ✓ Humidity affects the rate of transpiration. by the plant. ✓ As the air get humid, the rate of water lose by the plant is less.

Biotic Factors

What are the biotic factors?

Biotic factors are the living components of the ecosystem that influence the distribution and abundance of organisms in the environment.

- ✓ The biotic factors (the living factors) influence the ability of a species to survive and reproduce.
- ✓ The major biotic factors of the ecosystem includes.
  - ➥ Prey - predatory relation ship
  - ➥ Parasite - host relation ship
  - ➥ Herbivores - host relation ship

- The presence or absence of inset pollinators
- Pathogenes disease - causing of insect pollinators
- Competing organism.

Biotic Factors and their Ecological Relation - ship

These biotic interaction of organisms with individual of other species in the community limits the distribution, size and abundance of the population.

The interaction includes:

✓ **Competition:** competition is the interaction that occurs when individuals of different or the same species each compete for the resources that limits the survival and reproduction of both individuals. There are two types of competition:

i. Inter - specific competition: is competition between members of different species.

Example

- Competition between weeds and crop plants.
- Competition between lion and hyena.

ii. Intra - specific competition:- is competition between members of the same species.

- The competition may be for some resource like
- Competition for food
- Competition for mating
- Competition for territory

Example:-

- The competition between lion.
- The competition between dogs
- The competition between trees.

Predation (Prey - predator relationship):

Prey:- is an animal being eaten by another animal.

Example:- Gazzle, zebra, etc

Predator:- an animal that huntsand kills another animal for food

Example:- Lion, Tiger, etc.

Predation: is an interaction in which an individual of one species (the predator), kills and eats an individual of the other species (the prey) is called predation.

Parasitism:- One organism, the parasite, derives it's nourishment from an other organism, its host, which harmed in the process is called parasitism.

- The host is harmed and the paras it is benefited in the relation.

There are two types of parasites:

i. **Endo parasite:** A parasite that live and feed inside the host's body is called endo parasite.

Example:- Tape worm (flat worms) Ascaris (round worms).

ii. **Ectoparasite:** a parasite that attached and feed on the body surfaces of the host is called ecto parasite.

Example: Ticks attached on the body surfaces of cattle.

Mutualism:- is an interaction that benefits individual of both of the interacting species.

- Mulualism is common benefits, that both species are benefited in the interaction.

Example

1. Cellulose - digesting bacteria in the digestive system of termites and ruminant mammals.
2. Flowering plants and insects that involved in pollination.
3. The interaction of plant roots and fungus are called mycorrhizae in nutrient exchange. The plant transfer carbohydrates to the fungus while the fungus transfer phosphorus, sulfur
4. Algae and fungi interaction called lichens. Lichens = Algae + Fungi

Both partiners in a mutualism incur costs as well as benefites.

Commensalism: is the interaction between two organisms in which one partner is benefited from their relation and the other partner neither benefited nor be harmed.

It is neutral in which neither benefited nor be harmed from their relation.

Example

- Cattle and birds

- Crocodile and birds some birds pick meat reminants between crocodile teeth.
- Epiphytes get sunlight and nutrients by living on the host plant.

Table 6 . 2 The way in which Biotic Factors can Affect the population growth, distribution and size.

Biotic Factors	Interaction		How it influences the population size
Predation	+	-	The presence of large number of predators reduce the size of the preys.
Parasites	+	-	Parasites causes diseases, which reduces and affects the host.
Mutualism	+	+	Both species are benefited together in the association (interaction).
Competition	-	-	Both species suffer in the interaction
Commensalism	+	0	One partner benefited with out harming or helping the other partner. ✓ The other partner neither benefited nor be harmed.

Conceptual Example

1. Explain the difference between intra - specific competition and inter - specific competition

Explanation

The competition between members of the same specify is called intra - specific competition

Example:- Competition for mating between dogs. Competition for territores between lionees.

The cometition between members of different species is called inter - specific competition

Example:- The competition between crops and weds The competition for food between lions & hyenes.

2. List some a biotic factors that affect reproduction, abundance and distribution of organisms.

Explanation

Soil type, amounts of water, soil type, temperature, amounts of sun light, PH, humidity, in organic nutrients such as phosphorus, Nitrogen, sulfur.

3. List some biotic factors that affect living organisms

Explanation

Competition, parasitism, prey - predatory relation ship, commensalism, mutualism, diseases in sect pollinators.

4. What are the smallest and the largest ecosystem known?

Explanation

- The smallest ecosystem is known as pond
- The largest terrestrial ecosystem is known as equatorial forest region.
- The largest aquatic ecosystem is known as coral reefs.

Biomes

What is biomes?

Biome: a climatically and geographically limited ecological area that consistes of organisms that are adapted in similar ways is called biome.

A biome is a Geographical area with:

- a specific climate
- a specific soil type and
- a specific plants and animals that are adapted in asimilar ways to the abiotic conditions with in the area.

✓ Temperature and rain fall are the most significant climatic factors in determined biome type. These, in turn, are determined by geographical location.

Example: In the north pole, it is very cold and no or little rain fall.

✓ In the equatorial region very hot and high rain fall.

Classification of Biomes

Biomes are classified in to two major types:

A) Terrestrial biomes
B) Aquatic biomes

A) Terrestrial biomes:- is a biome consisting of an area of land

- ➥ It is defined by temperature: rain fall, soil type, plants and animals.

The characterics of the Major Terrestrial Biomes

1. Desert Biome

- ✓ are dry areas in temperate, subtropical, or tropical region.
- ✓ Cold desert: Are deserts in temperate regions.
  - ➥ Air temperature may fall below - 30°c
  - ➥ Temperature cold, almost no rain, and soil is poor.
  - ➥ In habited by some micro organisms, lichens, polar bears and seals.

Warm/ Hot/ Deserts: are found in tropics and subtropics.

- ➥ It has almost no rain
- ➥ Temperature is hot
- ➥ The soil is poor.
- ➥ In habited by plants and animals includes in sects, arachnids, reptiles, birds and succulunt (egg. cactus).

- ✓ Desert atmosphere has very low water vapour, leading to daily temperature changes from very very hot to very cold.
- ✓ Rain fall is is usually less than 250 mm per year.

Example of desert biomes:- Namib and kalhari desert in South Africa

- ➥ Sahara desert in north Africa
- ➥ Arabian desert.
- ➥ China's Gobi desert to the north of Himaly as
- ➥ Peru & chili's Afakama desert.

- ✓ Soil minerals content is high, and sometimes poisonus to the sparce plants.
- ✓ Organisms of desert biomes have structural, behave ioural and physiological adaptation to conserve water:

Desert Biome plants:

i. **Ephemerals:** are desert plant that complete their life cycle of germination, growth, flowering, and seeding with in very short period of time (i.e few weeks).

ii. **Perennials:-** are desert plants that pass the long dry periods as adults rather than seeds:

iii. **Geophytes:-** are ground plants in the desert biomes have under ground bulbs or corms. They live through, long period of drought and produce their above ground parts as soon as it rains.

iv. **Succulents:-** such as cacti and Euphorbia have no or reduced leaves. Leaves are photosynthesis takes place in the stem. They are succulent plants.

Xerophytes: are The collective name of plants that are well adapted to live in desert or dry environment.

Desert Biome Animals:- Such as rats, live in deep burrow and come out at night.

- ✓ Camels conserve water that would have been lost by evaporation to keep it cool.
- ✓ Camels hamp store fats that releases water during period.

Tropical Rain Forest:- located between 10°N and south of the equator.

- ✓ The richest biomes in species diversity.
- ✓ Evergreen, broad - leaf trees.
- ✓ Rain fall through out the year sum to an annual total of 2000 to 4500 mm/ year. and average temperature. of 25°c (77°F).
- ✓ little variation in day length, allow photosynthesis to continue year round.
- ✓ Plants are vertically layered, and competition for light is intense.
- ✓ Fully developed rain forest has three or four layers (levels) of vegetation
  - ➥ Very huge trees at the top most and exposed to direct sun light.
  - ➥ The middle layer gets less light.
  - ➥ The lower layer is consistes of plants adapted to shade.
  - ➥ Many of the trees have epiphytes and lianas.

Temperate grass land: are warm in summer but cold in winter.

- Annual rain fall is 25 to 100 cantimetes. With rain through out the year.

Boreal forests:- are also known as taiga or coniferous forest.

- Found south of the Arctic circle and across most of canada, Alaska, Russia and northern Europe.
- Days are longer in summer and shorter in winter.

Tundra:- long harsh winters and extremly short summers.

- It is located farthest north in eurasia, North America and their is lands between permanent ice and taiga.
- Rain fall is low (< 250 mm)
- Rain water is unavailable because it is frozen.
- Dominant plants are herbaceous consistes of mosses, lichens and some grass.
- Precipitation average 20 to 60 cm annually in Arctic tundra. Temperature is less than 10^0c
- Plant communities are called alpine fundra at very hight mountain tops at all latitudes.

B) Aquatic Biomes:- Aquatic biomes are sub - divided in two main type:-

- Marine biomes
- Fresh water biomes

What is aquatic biomes?

Aquatic biome is amarine biome or fresh water biomes. Marine biomes are biome consisting of a part of the sea and ocean.

- It has high salt content.

✓ The marine biomes which is the most diverse species of all marine habitat has many strata like rain forest is called coral reefs.

✓ Estuarine is aquatic biome which content. an intermectiate salt content.

✓ Estuarine is a transition area between river and sea.

Fresh Water biomes:- have no salt content.

Example:- pond, river, stream and wetlands.

✓ Mesophytes are plants that grow in well - watered environments are

called mesophytes.

✓ ***Hydrophytes;*** are plants that grow in water or water - dweller plants are called hydrophytes.

Biosphere (Ecosphere):- Athin layer of the atmospheric air the earth's crust the depth of the water body where living things are found is called biosphere or ecosphere. It is the broadest level in ecology.

Supplementary Exercise

Part II Choose the Best answer from the Given Alternatives.

5. The highest salt content of the aquatic bioes are
A) Fresh water biomes
B) aquatic biomes
C) Sea and ocean biomes
D) Marine biomes
E) C and D are correct

6. Which biomes of the world contain herbacious such as mosses, lichens, grasses, etc.
A) equatorial rain forest
B) desert biomes
C) Tundra biome
D) Coniferous (Taiga) blome

7. Aquatic biomes with an intermediate salt content is:-
A) Marine biomes
B) Wet land biome
C) Estuarine
D) Hydrophytes

8. Which aquatic biomes are nutritionally very rich to serve many plants and animal life:-
A) Marine biomes
B) Estuarine
C) Wet land biome
D) Hydrophytes.

9. Which of the following desert plants are adapted to their environment by having underground bulbs and corms:
A) Ephemerals
B) Grophytes
C) Succulunt
D) Perennials

10. Desert plant which complete their life cycle with in a very short life cycle:
A) Perennial B) Annula C) Scculunt D) Ephemerals

11. What is the collective name of plants that are well adapted to live in a very dry environment
A) Epiphytes
B) Hydrophytes

C) Xerophytes
D) Mesophytes

12. Water dweller plants are called _____

A) Xerophytes
B) Mesophytes
C) Hydrophytes
D) Epiphytes

13. Communities at early successional stages have __ relative to the more advanced communities of later stages.

A) Higher biomass
B) Lower productivity
C) More species
D) More stability

14. Which one of the following organization contain both biotic factors and non - biotic factors (abiotic):-

A) Community
B) Population
C) Ecosystem
D) Ecosphere

Ecological Succession

What is Succession?

The replacement of one community of the ecosystem by another higher community until the climax community is reached over time is called succession.

- ➥ Matured community developed gradually over time. It does not happen instantly.

✓ The first organisms (community) that able to colonize harsh environment and reproduce their is called pioneers community.

✓ The pioneer communities that colonize the habitate for the first time are lichens, fungi, algae.

✓ The living lichens grow in to the rock causing it to crumble. when the lichens die, decomposers acts on the remains to release mineral ions in to the crumbled rock. This form the primitive soil, and increase the soil thickness and it's organic content.

✓ The less harsh environment, and thick soil formed is suitable for mosses and liver worts change grow.

- ➥ Insuccession, ecosystems change from simple to complex commonity.

✓ The various stages in a succession are called seres

✓ The essence of succession:

- ➥ Organisms colonise an area.
- ➥ They change the abiotic (physical) conditions in the area.

- ➥ The changed a biotic conditions allow other species to colonise the area.
- ➥ They also them change the abiotic conditions more species enter and the process continue until the climax community reached.

As successive producers colonise the area, they create more and different habitats for other organisms to occupy.

- ➥ Succession usually involves an increase in the complexity of food weds.
- ➥ The final, most complex, highly stable state of community in succession is called **climax community.**
- ➥ As succesion proceeds, the amount and depth of soil increases, ecological niches and species diversity of the area increases.
- ➥ The ecological successions that may start on bare rock are called **xeroseres.** and those start on newly invaded water bodies are called **hydroseres.**
- ➥ There are two types of succession:

Primary and Secondary Succession

Primary succession: start on bare rock or lake.

- ➥ Previously uncolonised ground or newly formed pond (lake) with no life was colonise by the new, simple & unstable organism:

Algae & fungi lichens → Mosses liver worts → Perrenial herbs → scrub → Wood land forest (climax community)

Secondary succession:- When communities are destroyed by fire or by farmer ploughing a field or by others, like natural disastrous (volcano or flood).

✓ When anew succession begins in such an area it is called secondary succession.

✓ The secondary succession to reach to the climax community are much quicker than the primary succession because of the following reasons.

These are:- The succession is not starting from bare rock or open water. (thick soil is available).

- ➥ There is a seed bank available in the soil.
- ➥ The soil is already established.

Illustrative Example

15. Communities at early successional stages have ____ relative to the more advanced communities of later stages.

A) Higher biomass
B) Lower productivity
C) More species
D) More stability

Explanation

Communities at early stages of succession have lower productivity, lower biomass, less species diversity and less stability.

Answer: B

16. Which one of the following terms is most appropriate to collective refer to all the plants, animals and micro organisms found in Yayo forest in Ethiopia.

A) Ecology B) Ecosystem C) Community D) Population

Explanation

All the populations of organisms in an ecosystem are referred to as a community.

Answer: C

17. During which phase of succession is the total biomass of an area is greater;

A) Pioneer community
B) Early succession
C) Later succession
D) Tolerant community

Explanation

During the later stage of succession, species diversity, community stability and biomass increase.

Answer: C

18. Which biomes of the world has the most diverse of all?

Explanation

- Coral reefs has the most diverse of all the marine biomes
- Equatorial rain forest region has the most diverse of all the terrestrial (land) biomes of the world.

19. In which of the following organisms are pioneer colonizers of bare rock?

A) Shrubs B) Ferns C) Lichens D) Mosses.

Answer: C

End of unit review exercises

Part I Choose the Best Answer from the Given Alternatives

1. Large geographical and climatic region with their specific plants and animal species is called ____

A) Ecosystem
B) Biosphere
C) Bimes
D) Community

2. Biomes are mainly defined by their

A) Climate
B) Soil type
C) Hydrological
D) Vegetation

3. Which of the following factors is **not** used in the characterization of terrestrial (land) biomes?

A) Rain fall
B) Soil type
C) Temperature
D) Salt content

4. In which of the following biomes are epiphytes typically found as characterstic element:-

A) Tundra
B) Boreal forest
C) Tropical rainforest
D) Cold forest

5. Desert plants which complete their life cycle with in very short time are:

A) Perrenial B) Succulunt C) Annual D) Ephemerals

6. What is the collective name for plants that are well adapted to live in very dry environments?

A) Epiphytes B) Xerophtes C) Mesophtes D) Hydrophyts

7. Which is the following is more likely to ensure the conservation of all the rest?

A) Soil conservation
B) Plant conservation
C) Water shed conservation
D) Wild life conservation

8. Which of the following biomes is dominated by ever green coniferous vegetation

A) Boreal forest (Taiga)
B) Tundra
C) Tropical rain forest
D) Temperate rain forest

9. A group of or one species in the same place at the same time is:-
A) Ecosystem
B) Community
C) Population
D) Biome

10. The interaction between organisms in which one partener is benefited where as the other neither benefited nor be harmed is called.
A) Mineral ions
B) commensalism
C) Parasitisim
D) Prey - predatory relation

11. Which is the biotic in an Atakama desert ecosystem:
A) Mineral ions
B) Soil type
C) Predator
D) Temperatur

12. A cow tick and the hose are an example of what type of symbiotic relation ship:-
A) Prey - predatory
B) Mutualism
C) Parasitism
D) Commensalism

13. Which is the broadest level in the study of ecology?
A) Ecosystem
B) Biomes
C) Biosphere
D) Community

14. Which list shows the correct order of organization from simple to complex?
A) Cell, community, organism
B) Organism, communits, population
C) Cell, organism, population, community
D) Cell, organism, ecosystem, population.

15. Which completely describes the components of an ecosystem?
A) All the living things on earth in one area
B) A group of population living in one area
C) A community of organisms and their physical environment
D) All the organism of one species that live together and interbreeds

16. Which of the following is a major factors to determines climax community:
A) Temerature and rain fall
B) Grazing and browsing animals
C) Radiation & reflection

D) Predator and prey.

17. The different stages ecological succession is:-
A) Steres
B) Seres
C) Pioneers
D) Climax

18. Which of the following is unique habitate from the marine biomes due to the mixing of salt water and fresh water?
A) Ocean, abyssal
B) Coral reefs
C) Estuarine
D) Ocean, pellagic.

19. Which factors dose not affect the type of climax community that may develop in an area:-
A) Soil type
B) Precipitation
C) Temperature
D) Thunder storm

20. Which one is a biotic factor that can influence a plant?
A) The PH of the soil
B) CO_2 concentration
C) a pollinating animal
D) a mounts of light energy

21. Terrestrial biomes are largely affected by:-
A) Wine and temperature
B) Temperature and rain fall
C) rain fall and wind
D) light and rain fall

22. The final, stable and most complex stages reached in the succession:
A) Pioneer community
B) Seral community
C) Climax community
D) Secondary community

23. What is the main reason for the high species richness of plants and mammals observed in Ethiopia?
A) Efficient Management of the ecological resource
B) Presence if several biomes with in the country.
C) Lack of predators
D) Lack of disturbance.

24. Which of the following concepts contains all the others?
A) Community
B) Population
C) Genus
D) Species

25. Which of the following is the primary sources of energy for all the others?
A) Consumers
B) Herbivores
C) Decomposurs
D) The sunlight

26. Plant roots and mycorrizae fungi are an example of which type of

interaction of organisms:-

A) Commensalism
B) Mutualism
C) Parasitism
D) Epiphyism.

Part II Matching Item

A	B
27. Abiotic factors	A) Earth worm, insects, plants & animals
28. Parasitism	B) atick on a cow
29. Biological community	C) An owl eating a mouse
30. Habitate	D) Cold temperature and high wind that prevent trees
31. Prey - predatory relationship	E) The first organism that to envad on anew cooled, hardened lava.
32. Limiting factors	F) An old forest that has not had any fire damaged in over 200 years.
33. Secondary succession	G) Weeds and wild flowers beginning to grow in a field after acorn crop is harvested
34. Pioneer species	H) A place where plants and animals are living
35. Primary succession	I) Previously uncolonised ground or newly formed pond were colonized by the new one.
36. Climax community	J) rain fall, soil type, temperature, sunlight intensity.

Part III Fill in the blanks spaces with the following words to make a correct statement.

Rain forest, coral reef, Tundra, desert Phytoplankton, mutual ism, Biotic facton, Biomes, Biosphere.

37. The _____ biome is ahome to more types of life than any other biomes in the terrestrial environment.
38. The _____ is so cold that very little life exists there.
39. The _____ biome is a home to more types of life than any other biomes

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in aquatic environment.

40. The driest biome is _____ biome.
41. Aquatic photoautotrophs which is a base for food chain is _____
42. The association between living things in which both organisms are benefited in the interaction is _____
43. The living factor that influence the organisms to reproduce, distribution and abundance of organism is _____
44. Large ecological and climatic regions where a specific plants and animals are living _____ .
45. A thin layer of atmospheric air, the crust of the earth, and the depth of water where living things are found is called_____ .

Answer Key

Supplementary Exercises

Part II. Multiple choice item

5.E	7. B	9. B	11. C	13. C
6.C	8. B	10. D	12. C	14. C

Answer key for

End of unit review Exercises

Part I. Multiple choice Item

1. B	5. D	9. C	13.C	17.B	21.C	25.D
2. A	6. B	10.B	14.C	18.C	22.B	26.B
3. C	7. B	11.C	15.C	19.D	23.B	
4. C	8. A	12.C	16.A	20.B	24.A	

Answer Key

End of unit Review Exercises

Part II. Matching

27.J	29.A	31.C	33.G	35.I
28.B	30.H	32.D	34.E	36.F

Part III. Filling the blanks spaces items

37. Rain forest
38. Tundra
39. Coral reefs
40. Desert
41. Phytoplankton
42. Mutualism
43. Biotic factors
44. Biotic
45. Biosphere

UNIT 7

Sub - Fieldes of Biology

7.1 Sub - Fields of Biology

Introduction

The Scope of biology is so broad that it contains many branches and Sub - desciplines .

Based on the type of organism it Studies, biology is sub divided in to three categories These are :

- Zoology
- Botany
- Micro biology

i. **Zoology** : is a branches of biology which studies about animals is called Zoology It is animal biology

- Zoology includes disciplines such as :
- Herpetology : is the study of reptiles.
- Ichthyology : is the study of fish.
- Mammalogy : is the study of mammals.
- Ornithology : is the study of birds.
- Entomology : is the study of insects.
- Zoology is concerned with all aspects of animal life; such as

embryonic development to mature adult hood ; behaviour, and genetics.

ii. Botany : A branches of biology which studies about plants is called botany.

- It deals with plants structure, properties, and biochemical processes.
- It also studies about classification and diseases of plants and their interaction with the environment.
- Applied plant sciences are agriculture, horticulture, and forestry.
- Plants are used as a sources of food, shelter, clothing , medcine, tools and ornaments.
- Plants are essential to all life on earth.

iii. Micro biology : a branches of biology which studies about microscopic organisms or microbes that can not be seen by unaided eyes.

- Microbes includes bacteria, protozoa, viruses, archea, microscopic algae and fungi.
- Micro biology is sub divided in to sub disciplines such as :
- Bacteriology : is the study of bacteria.
- Mycology : is the study of fungi.
- Parasitology : is the study of parasitic micro organisms.
- Microbiology is a rapidly expanding fields of study . However, new technology and developments in the field are constantly assisting in the identification of new species.

In addition to these three sub - fields, there are a huge array of sub - disciplines or fields of biology, such as ecology, morphology Anatomy, molecular biology, etc.

Table 7.1 Different fields of Biology Based on the structure studied.

Sub - Branch of Biology	Definition	Example of the Structure Studied
Morphology	Study of external form and gross Structure	Shape, texture of leaves, stem, skeletones, etc
Anatomy	Study of the bodly structure of human, animals, and other organisms. Especialy as revealed by dissection and separation of parts	Stomach, liver, heart, kidneys, etc
Histology	The Study of tissues structure	Connective tissues, Parenchyma, etc
Cytology	The study of Cells	Nerve cell, blood cell, plant cell, etc.
Cell Biology	Study of the Structure, Function various aspects of cells and it 's components	Nucleus, mitochondria, chloroplast etc.
Molecular Biology	Study of structure and functions of informational molecules.	Nucleic acid (D N A, R N A)

Table 7 . 2 Subjects Studied in Various Branches of Biology

Branches of Biology	Subjects Studies	Examples
Physiology	The function of living organisms and their parts	Photosynthesis, digestion, respiration e t c
Embryology	The study of embryo, from a single called zygote to the formation of form and shape	Structure and development of ova, sperm, blastula (embryo early development of a ball of cells), gastrula (after blastula, develops two layers).
Ecology	Interactions of organisms among themselves and with the environment.	Food chain, biomass, biosphere, autotrophs, heterotrophs, decomposers
Taxonomy	Identification, grouping, classification and nomenclature of organisms.	*Homo Sapiens,* (modern man) placed in animal kingdom *Eregrostif tef* teff belongs to plant kingdom
Paleaontology	Origin, development and structure of fossils	Fossils (remains of plants and animals)
Genetics	The study of heredity And variation	Gene concept
Exobiology	The Origin, evolution, distribution and future of life in the universe.	Life on mars, Life on moon

Biology is related to other Sciences that study life, as an energy state of all living things, their interrelationship, and links to their surroundings.

Table 7 . 3 knowledge taken from other subjects that helps to explain biological phenomenon.

Structure/ Mechanism Studied	Example	Related Science	Knowledge of other Sciences is required because
Cell membrane	Structure of Lipids and proteins	Chemistry	Living organisms are made up of organic and Inorganic Compounds
Transportation of O_2 in the body	Formation of oxyhaemo globin (Haemoglobin + O_2)	Chemistry	All metabolic path way involves chemical change
Absorption of food (water)	Absorption of glucose, amino acids, fatty acids, water, mineral salt.	Chemistry	During diffusion and osmosis molecules are move into and out of the cell.
Excretory System	Absorption and elimination of Salts	Chemistry	Homeostasis involves acid - base equilibrium to maintain the PH.
Transportation of Water in Plants	Conduction of water from roots to leaves	Physics	Water has a properties of cohesion and adhesion results in surface tension and capillary action.

Traping of light energy in plants	Chlorophyll traps light energy in the leaves to make food (chemical energy)	Physic and chemistry	The green plgment trap light energy dury photo synthes is in plants Transduction
Release of energy during respiration	Electron transport chain (ETC) from electron do or to acceptor	Chemistry	Energy transfer and transport

7.2 Pure and Applied Fields of Biology

What do we mean by pure and applied fields of biology ?

Pure biology : is the study of how life functions in nature (behavior, Internal and external structure, reproduction , e t c) is called pure biology It is the study of plants or animals anatomy and morphology .

Applied Biology : is using what you have learned in biology applied for gardening, forestry, agriculture, poultry, plants and animal diseases, nursery work, medicine, e t c) is called applied biology.

Applied biology is there fore, the use of your knowledge of biology applied to practice and manage life.

A pure area of biology is the study of the structure of a plant or animal, for example anatomy and morphology, where as applied biology is the application of what we know about the anetomy, morphology and physiology of organisms to treat their malfunctioning as a result of infectious illness

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Table 7 . 4 Categores of pure and Applied Fields of Biology

Fields of biology	Pure biology	Applied biology
➥ Agriculture . Poultry ➥ Forestry . pathology ➥ Apiculture . Physiology ➥ Biotechnology ➥ Pharmacognosy ➥ Sericulture . Entomology ➥ Paleaontology . Pisciculture ➥ Apiculture . Agroforestry ➥ Embryology ➥ Taxonomy ➥ Animal husbandry ➥ Histology ➥ Morphology ➥ Evolution ➥ Molecular biology ➥ Horticulture ➥ Cytology ➥ Plants and animal diseases	➥ Morphology ➥ Taxonomy ➥ Cytology ➥ Embryology ➥ Histology ➥ Molecular biology ➥ Evolution ➥ Pathology ➥ Physiology ➥ Paleantology ➥ Bacteriology ➥ Entomology ➥ Cy tology	➥ Plant diseases ➥ Animal diseases ➥ Forestry ➥ Poultery ➥ Agriculture ➥ Horticulture ➥ Poultry ➥ Agro forestry ➥ Pisciculture ➥ Sericulture ➥ Pharma cognosy ➥ Biotechnol ogy ➥ Animal husbandry ➥ Apiculture

Key Terminology

Apiculture : keeping of honey bees

Pisciculture:The branche of animal husbandry concerned with the cultivation of fish or sea animals.

Sericulture : The process of rearing silk - producing insect (worm).

- Sericulture is the production of silk from silk - worms through Rearing practice.

Horticulture : The science and art of growing, producing, marketing and using high value ornamental plants and food plant. Example of horticultural crops are attractive plants, fruit and vegetable, ornamental plant

Agroforestry : The delibrate incorporation of trees and shrubs in to crop and animal production systems in order to generate economic, environmental and social benefits.

Pharmacognosy : The Study of medical drugs obtained from plants, animals and microbes

Illustrative Examples

1. A branche of biology that study about fish is

A. Ornithology
B. Ichthyology
C. Herpetology
D. Entomology

Answer : B

Explanation

Ichthyology is a science that studies about fish

2. One of the following is not the applied plant science

A. Forestry
B. Agriculture
C. Histology
D. Horticulture

Answer : C

Explanation

Forestry, agriculture, horticulture are applied plant science but histology is a pure biology that study about tissue structure.

3. A branches of biology that studies about the interaction of organisms among them selves and with their environment is

A. Embryology
B. Ecosystem
C. Taxonomy
D. Ecology

Answer : D

4. A science that studies about the origin evolution, distribution and future of life in the universe, Mars and Moon is :-

A. Genetics
B. Exobiology
C. Embryo log
D. Palaeontology

Answer : B

5. Sub - branches of biology that studies about the body structure of plants and animals is called ____

A. Morphology
B. Anatomy
C. Physiology
D. Cytology

Answer : A

Explanation

Anatomy is a science that studies about the body structure of organisms parts by parts. This is done by dissections of animals to see the internal organs parts by parts.

6. What is the molecular biology studies about ?

A. Cell
B. Internal organs
C. D NA and R N A
D. Organ clles

Answer : C

Explanation

The molecular biology studies about the structure and functions of informational molecules .

They are called nucleic acids specifically the molecular biology studies about the structure and functions of DNA and R N A.

7. The Sub branches of micro biology that studies about the parasitic micro organisms is called ____

A. Mycology
B. Bacteriology
C. Virology
D. Parasitology

Answer : D

8. Which discipline of science assistes to understand the release of energy during cellular respiration in biology ?

A. Geology
B. Chemistry
C. Geography
D. Physics

Answer : B

Explanation

The electron transport chain (E T C) from the donor to acceptor transfer and transport energy in Ceelular respiration . This is done in aseries of steps of chemical reaction . This steps of chemical reaction is analysed by chemistry.

9. Which studies of related science helps to understand biology in transportation of water in plants ?

A. Physics
B. Chemistry
C. Geology
D. Mathematics

Explanation

The knowledge of Physics is required to understand the properties of water, cohesion, adhesion results in surface tension and Capillary action. This Properties conduct water from the soil to roots and to the leaves. There fore, in this physics knowledge is required to understand biology

10. The Process of rearing silk - producing insect or worm for the production of silk is Called___

A. Pisciculture
B. Sericulture
C. Horticulture
D. Apiculture

Answer : B

Explanation

- Sericulture is the process of rearing silk - worm
- Pisciculture is the process of cultivation of fish
- Apiculture is the process of keeping honey bees
- Horticulture is the science and art of growing and producing ornamental plants.

Some of the Biological Importance of the branches of biology in other branches of Science

i. **Biotechnology** : is the use of living organisms (micro organisms) or their products to solve the practical human problems in medicine, agriculture, energy, food, pharmacetical, etc.

ii. **Genetic Engineering** : The transfer of genetic materials (DNA or gene) from an organism to another (of the same or different) as a result an organism develops anew combination of genes is called genetic engineering.

- The organism whose genetic materials are modified as a result of inserting gene from an other organism is called Transgenic

organism or genetically modified organism or genetically engineered organism.

iii. **Bio informatics** : is Concerned with the acquisition, analysis and dissemination of biological data such as DNA, R N A, and amino acid sequences.

iv. **Biomedical Engineering** : is the application of the principles and problem - solving techniques of engineering to biology and medicine to improve human health

v. **Forensic Science** : is the application of biological knowledge of DNA finger printing and blood typing for physical investigation of crime and civil law.

vi. **Environmental Management**_: deals with environmental observation and finding out the solution to maintain the balance of nature.

7.3 Major Discoveries in Biology

Biology is a fascinating and diverse subject area.

The major discoveries that revolutionized Biology are :

1. Galen (129 - 161 AD)

Galen's efforts was on medical transformations including Anatomy, pathology, physiology and Neurology.

His findings were also include the distinctions between veins and Arteries and also Larynx produces voices.

2. Anton van Leeu wenhoek (1632 - 1723)

- Well renowned for his contribution to microscopy, whose magnification power up to 500 times.
- He was the first person to see living moving microbes such as bacteria and protozoa in adropes of water.

3. Carl Linnaeus (1707 - 1775)

- He was a botanist, physician, and naturalist, a founder of the two kingdom - system of nomenclature of living organisms.
- He devises a system for Classifying and naming species and further order, genus and species.

- Scientific name given to species by using two Latin words called Genus and species name.

4. Charles Darwin (1809 - 1882)

- The most famous naturalist, contribution to biology and society is immense.
- He was called the father of evolution.
- All species of life descended over time from common ancestors, with species continuing to exist through the process of natural selection.
- Evolution by natural selection combined with mendlian genetics is now accepted as the modern evolutionary synthesis.

5. Gregor Mendel (1822 - 1884)

- Gregor Mendel was called the father of genetics. Genetics is the science that deals with heredity and variation.
- He made experiments on garden pea plant (*Pitsum Sativum*) that he was the first person experimentally prove the hereditary transformations of traits from parents to their off springs.
- He also coining the terms" dominant" and "recessive" genes in the process of hereditary transformation.

6. Louis Pasteur (1822 - 1895)

- Louis pasteur is regarded as the father of medical micro biology.
- His contributions to science, technology, and medicine are nearly unparalleled in history .
- He demonstrated that bacteria causes an infectious disease and fermentation.
- He had introduced pasteurization, rescued france's beer, wine and silk industries, and developed Anthrax and Rabies vaccines.
- Louis pasteur also pioneered the theory called *Germ Theory* which states that micro organisms are agents of infectious diseases.

7. Robert koch (1843 - 1910)

- Robert koch was a pioneered micro biologist.
- He was the father of modern bacteriology
- He is credited with pin pointing the precise causual agents of tuberculosis (TB) cholera, and Anthrax, as well as providing experimental support for the concept of infectious disease.

8. Watson_(1928 -) and Crick (1916 - 2004)

- James Watson and Francis crick were proposed a double stranded DNA - structure
- Their model of DNA (Double helix)

They Explain : how DNA replicate itself

- How hereditary information is coded
- How hereditary information is passed on to descendants.

The discovery of DNA structure has led to more developed understanding of the function of DNA ; which is

- Used in disease diagnosis
- Treatment of diseases
- In transgenic organisms
- In forensic finger - printing and more.

Illustrative Examples

11.Choose the one which is different from the other (E U E E, 2005 E. C)

A. Genetically modified organisms
B. Genetically engineered organisms
C. Pathogenic organisms
D. Transgenic organisms

Answer : C

Explanation

All are the same except pathogenic organisms

Pathogenic organisms are disease causing organisms All the others (A, B and D) represent organisms whose genetic materials are modified as the results of transfering gene or DNA from one organism to the other.

12.A taxonomist who is the founder of the two kingdom system of nomenclature

A. G Mendel
B. Galen
C. Carl Linnaeus
D. L Pasteur

Answer: C

Explanation

Carl Linnaeus is the father of taxonomy He systematically classifying grouping and naming species. He gave scientific name by using two Latin words, Genus name and species name

13. The first person to saw the living, and moving cells in a drops of water by using his microscope is

A. Robert Hooke
B. Anton van Leeuwen hock
C. Charles Darwin
D. Leuis Pasteur

Answer: B

Explanation

Anton van Leevwenhock revolutionized the study of micro organism by using his advanced magnified lens of microscope He was the first person try to see micro organisms such as bacteria and protozoa in a drops of water.

14. What is the role of Galen in medical transformation ?

Explanation

- In medical transformation Galen efforts shown in anatomy, pathology, physiology and neurology
- Veins and arteries are also separatly shown
- The sources of sound shown by Galen that the voice box is called Larynx.

15. Who is called the father of evolution ? Explain

Explanation

Charles Darwin is called the father of evolution. His theory of evolution is called the theory of natural selection or Darwinism. He states in his theory that all species of life descended over time from common ancestors species continuing in change through the process of natural selection.

7.4 The contributions of Biological Discoveries to Society and the Environment

The biological discoveries helped human beings in developing abilities required for the use of living systems or influencing natural processes to produce products, system, or settings that aid in human developments.

The invention of devices such as microscopes, the discoveries in medicine and the inheritance or the application of genetics are some biological discoveries and their impacts on human society and the natural environment are described below.

1. The Discoveries of Microscope

The microscope is a device that magnifies objects or organisms that are too small to be seen with the naked eyes.

The invention of microscope has had an influence on the development of modern medicine, forensic science, and environmental science.

The invention of the microscope has revolutionized the science industry while developing other fields :

i. Medical Fields :

The use of Microscopes in medicine began when Louis pasteur reported that micro organisms are an agents of infectious diseases.

☑ Pasteur's germ theory revolutionized the process of identifying, treating, and preventing infectious diseases.

☑ Hospital laboratories use microscope to identifies which microbe is causing an infection .

ii. Forensic Science

Forensic science is a field of science used to gather, analyze and investigate evidences to establish facts that are used in legal scenario

The microscope is used to examine piece of evidence collected at a crime scene that may have not visible to the human eye.

iii. Atomic Study

The invention of electron microscope has enabled scientists to study cells and also understand the types of viruses and understand how they infect the body.

iv. Genetic Study

The microscope has had a significant impact on genetics research. A micro scope is used by scientists to examine certain genetic make up. This allows scientists to evaluate genetic abnormalities, regeneration and tissue death.

v. Tissue Analysis

Histologists study cells and tissues using a microscope.

2. Discoveries in Medicine

The discoveries in medicine is so great that they have a great impacts in our daily life.

The first model antibiotics is called Pencillin which is introduced by Sir Alexander Fleming in 1928.

Antibiotics is made from a fungal species called *Penicillium notatum*. Pencillin is chemical used tokill bacteria inside our body. These chemical can kill bacteria with out damaging our body.

The other types of chemicals that are used to cure fungal disease are called **anti fungal chemical.**

These are similar to antibiotics but can kill fungal cells.

However ; viral diseases have not yet been treated by using any kind of drugs. Thus, medical scientists are working so hard to develop effective drugs against viral diseases.

Table 7 . 5 Types of discoveries in Medicine and their relevance

Types of Discovery	Who Discovered	Benefits
The Circulatory System	➡ By Physician I b n al - Nafis, and first brought prominance in 1628 by william Harvey	For better understanding of human body.
Vaccination	Edward Jenner France, 1799	Prevension of diseases
Insulin	Frederick Banting, 1920	Regulation of the blood - sugar level
Pencillin	Alexander Fleming 1928	Antibiotics (causes of diseases
Germ theory	Louis Pasteur, 1861	➡ Identifying Causes of diseases ➡ Hygien practice to prevent disease
Vitamines	Frederick Hopkins in the 1900s	➡ Understanding nutrients ➡ Prevent illness related to deficiency.
HIV	Robert Gallo and Luc Montagnier, The 1980s	➡ To a greater awareness of the dangers of unprotected sex
Aesthetic	Sigmund Freud and karl kollar in 1884	➡ Aenstetia to have an operation
X - ray	Conrad Rontgen in 1895	To identifying broken bone and internal body.

Illustrative Examples

16. Who discovers the first antibiotic called pencillin

A. Pasteur
B. Jenner's
C. A. Fleming
D. F. Hopkins

Answer : C

Explanation

Alexander Fleming discovers the first Pencillin from a fungal species called *Pencillium notatum*.

17. The theory which states that an infectious diseases are due to causative agents called micro organisms is

A. Pasteurization
B. Germ theory
C. Vaccination

Answer : B

18. Who discover Vitamines to understand nutrients is related to deficiency diseases.

A. Robert Gallo
B. Conrad Rontge
C. L Pasteur
D. Frederic Hopkin

Answer : D

19. Who discovered the Circulatory System in human
A. Ibn - al - Nafis
B. Edward Jenner
C. Frederick Banting
D. Robert Gallo

Answer : A

Explanation

Ibn al - Nafis discovered Clrculatory system in human for the first time and brought prominent in 1628 by neiuiam Harvey.

20. The first model antibiotic, pencillin, extracted from a fungal species called ____
A. *Pencillium notatum*
B. *Phytolecca dodecandria*
C. *E. Choli*
D. *Mycobacterium spp.*

Answer : A

21. What type of Chemical that are used to cure fungal diseases ?
A. Pencillin
B. Anti fungus
C. Anti bacteria
D. Pesticide

Explanation

Anti fungal Chemical kills fungi but not bacteria - Anti fungi chemicals kills fungi cells.

3. Inheritance (Application of Genetics)

Gregor Mendel was the father of genetics. After the discoveries of his work and his law, Genetics took a progressive turn and revolutionized. Working on genetics is still moving.

Genetics is providing numerous services to humanity in almost every field of life, such as in :

- Agriculture
- Medicine
- Immunity
- Inheritance
- In food industry
- In biological diversity, e t c

i. Application of Genetic Discoveries in Agriculture

Plant breeders used to produce new varieties, improved levels of tolerance and resistance to environmental challenges, resistance to biotic challenges, improved level of tolerance and resistance to weeds and draught. To improve high yields of crop varieties

- The new genetics will link agriculture to industry

ii. Application of Genetic Discoveries in Medicine

A medical geneticist is a physician who works as part of a *clincal team* that includes other physicians, nurses, and genetic counseller to evaluate patients for possible hereditary diseases.

They assess risk and possible modes of inheritance indicate diagnostic testing, manage prevention and treatment.

iii. Application of Genetic Discoveries in Immunity

Immune responses to infectious disease agents are known to be influenced by both genetics and non - genetic factors.

- The medical and veterinary applications of genetic variation with well - defined genetic role in host - immune response and susceptibility to infectious diseases. Thus, the ability of the body to defend against disease causing pathogens is called Immunity.

iv. Application of Genetic Discoveries in Inheritance

Since 2004, the European society of Human Genetics and the European society for Human Reproduction and Embryology have collaborated to assess reproduction and genetics, including their application in clinical practice.

The gamete donors, genetic causes of male and female infertility, the use of massively parallel sequencing in pre implantation genetic testing, and non - invasive pre implantation genetic testing.

v. Application of Genetic Discoveries in Biological Diversity.

The significance of plant and animal genetic diversity is now being recognized as a distinct area.

Agricultural scientists discovered that plants and animal genetic diversity can be captured stored as in the from of plant and animal genetic diversity genetic resources such as gene banks, D N A libraries, e t c that preserves genetic materials for a long period of time.

- Plant breeding researches are essential for improving varieties of food production, the availability and accessibility to diverse genetic sources will ensure the global food production.

Conceptual Examples

22. Explain how the discovery of a microscope is related to the invention of medical field ?

Explanation

The invention of a microscope is revolutionize the development of medicinal field in that :

- Micro organisms who are the agents of infectious diseases are identified by microscope.
- Microscope helps us to identifie which micrbe is causing an infection.

23. Explain how the discovery of a microscope is related to the invention of forensic science ?

Explanation

Forensic Science is a physical investigation of evidences to establish facts in a crime scene.

The microscope is used to examine piece of evidence collected, analysed and investigate at a crime scene that may not be visible to the eyes.

24. Mention the contribution of biological discoveries in medicine to solve the practical problems of the societies ?

Explanation

The biological discoveries in medicine that helps to solve the practical problems of socities are

- Vaccination to prevent disease pathogenes
- Insulin to regulate blood - sugar level.
- Pencillin, anti biotics
- Aesthetics, x - rays, Vitamines, H I V

25. What does immunty mean ? what is the application of genetics in immunity ?

Explanation

Immunity is the ability of the body to defend aginst disease pathogens. Genetics play important role in hose - immunity response and susceptibility to infectious diseases development.

26. Mention the role of genetics in plant breedings ?

Explanation

Pland breeders using the application of genetics used to produce :

- New varieties of crop productions that resist draught, insect pests and fungal infections.
- New varieties of crops with high yield productions .
- New varieties with high tolerances to environmental changes and biotic challenges.

27. Name the two scientists who introduced the structure of double helix of D NA structure.

Explanation

James Watson and Francis Crick introduce the first DNA model, structure, the double helix of DNA molecule. Watson and Crick DNA model shows DNA is a double helix and it is the basis of all our modern molecular genetics.

28. Mention fields of biology that are related to other sciences

Explanation

Biology is related with other fields of studies, such as physics, chemistry, Mathematics, geology, geography, e t c

- They can be biochemistry, biophysics, biogeography, biogeology , e t c are close interrelationship between biology and other sciences.

29. How biology and chemistry are interelated in biochemistry ?

Explanation

- Biochemistry is called the chemistry of life
- Biochemistry is a descipline of science that investigates the chemical

processes that occurs with in living organisms.

- Biochemistry is a laboratory science that combines biology and chemistry.
- Biochemists can comprehend and address biological problems by applying chemical knowledge and procedures.
- It investigates what happens inside our cells such as proteins, lipids and organ cells
- Biochemist understand how molecules structure related to it's functions.

30. How biological studies help human to keep healthy life ?

Explanation

- Biology has an impact on our daily life. Because biology is linked to our basic needs for food, clothing, fuel, and many others enable us live healthy lifestyles.
- Biology teaches us proper fitness, personal hygiene, nutrition, disease prevention, healthy life style, and among other things.

31. How biology and physics inter relation form a study termed biophysics?

Explanation

- Biophysics is a branches of physics that studies biological systems using physics ideas and methodologies.
- Biophysics observation can be explained using physics technologies such as the use of electron microscope, spectroscopy, X- ray crystallography and scattering effects.
- Statistical mechanics and thermodynamics from physics can be applied to biophysics to better understand biological system.

32. What do we mean by pure biology ?

Explanation

Pure biology is the study of the structure of plants or animals anatomy and morphology. It is the study of how life function in nature in internal and external structure, reproduction behavioure, e t c .

33. What do we mean by Applied biology ?

Explanation

Applied biology is the application of what we know about the anatomy, morphology and physiology of organisms (plants or animals) applied for :-

- Treating their malfunctioning as a result of infectious illness.
- Forestry, agriculture, poultry, e t c

34. Discuss the role of genetic discoveries in agricultural development.

Explanation

The application of genetics to agriculture has led in significant improvements in the production of several crops. This is especially in hybrid maize and sorghum strains simultaneously, cross breeding has resulted in significantly more productive wheat and rice cultivars.

35. Why does biology rely on mathematics to gain knowledge and for better understanding of biology ?

Explanation

Biology employs mathematical rules to process, analyse, and present experimental research on a wide range of phenomena in living organisms

36. Why does biology rely on chemistry to gain knowledge and for better understanding of biology

Explanation

Chemistry has aided biologists in describing metabolic processes in our bodies such as digestion, breathing and respiration e t c , photosynthesis and transports of materials in green plants are described by the aid of chemistry knowledge.

- Chemistry aids in understanding of the reactions that occurs during various processes in living bodies
- The acid - base equillibrium maintains specific PH for living organisms, the impacts of inorganic ions dissolved in water and exists as ions in living things as well as the organic compounds in living things described and understand by the aid of chemistry.

37. Why does biology employs history ?

Explanation

- Biology employs historical knowledge to date the evolution of species.
- History is also a subject that biologist use to create specific species based on seasons and historical areas.

38. Why does biology applied geography knowledge for better understanding of biology ?

Explanation

Biology applied geography knowledge to explain :-

- Earth's element which are essential in studying evolution, structure, and origin of the earth (our planet)
- The ecosystem where living things are living and interact.
- The topography of the earth which inhabits living organisms

39. Mention the contribution of biological discoveries of microscope in genetic study ?

Explanation

The discoveries of tools of biologist called microscope contribute in the genetic study is in examining and evaluating genetic abnormalities, regeneration, and tissue deathes.

40. How does chemistry knowledge is required to understand the biological cell membrane ?

Explanation

The biological cell membrane (or plasma membrane) is consistes of components of lipids and proteins.

The structure of lipids and proteins are studied by chemistry. The organic and inorganic contents of the compound is also studied by chemistry. There fore, chemistry knowledge is mandatory to understand the structure, and component parts of cell membrane.

41. Categorize the following fields of biology in to pure and applied biology.

A. Animal and plant disease
B. Poultery
C. Horticulture
D. Physiology
E. Entomology
F. Embryology
G. Agriculture
H. Taxonomy
I. Forestry
J. Biotechnology
K. Bacteriology

Explanation

Pure Biology	Applied Biology
➥ Physiology ➥ Entomology ➥ Taxonomy ➥ Embryology ➥ Bacteriology	➥ Animal and plant diseases ➥ Poultery ➥ Horticulture ➥ Agriculture ➥ Forestry ➥ Biotechnology

7.5 Ethiopian biologists and Their contributions

Some of the major discoveries of Ethiopian biologists are given below:

1. Professor Yalemtsehay Mekonnen

She is an Ethiopian biologist in Addis Ababa university, Faculty of science-she received her P h - D, specializing in human physiology, from the university of Heidelberg in Germany. Her research area is :

- The assessment of the impacts of chemical pesticide hazards on human
- The use of plants as medicine against human and animal diseases
- She has published over 100 scientific journals in the area of plants of medicinal and nutritional value invivo and in vitro physiological tests of useful plant extracts, assessment of health hazards to humans, animals and the environment

2. Dr . Aklilu Lemma

Schistosomiasis or Bilharzia is a common parasitic disease. It is caused by parasitic flat worms which parasitizes human It affects more than 300 million people living in Tropical areas of Africa, south America, Asia and parts of caribbians.

Dr. Aklilu Lemma works on the battle against bilharzia or schistosomiasis.

- The bilharzia worm uses fresh water snail as an intermediate host in which it spends some parts of its life cycle.
- Dr . Aklilu Lemma made soup berry from a plant which is commonly called Endod in Ethiopia or Phytolecca dodecandria is used to eradicate snails which are an intermedite hosts of bilharzia worn. This discovery is made based on the observation which Dr . Aklilu Lemma made around Adwa in 1964.
- The soup berry of Dr . Aklilu Lemma is advantageous over the molluscicide chemicals because it is cheaper and afford able for more Africans to buy and use it.
- Based on his discoveries Dr . Aklilu Lemma recognized his discoveries by saying we found a poor man's medicine for a poor man's disease.

3. Professor Gebissa Ejeta

Professor Gebissa is highly recognized for his work on developing stains of sorghum which are resistant to drought, fungus, parasitic striga weeds and produce high yield crops which is up to ten times.

Accordingly, the contribution of Prof . Gebissa has made a massive difference in sustaining the food security in Ethiopia and other African conutries.

For his massive contribution in science and technology Prof. Gebissa awarded the National Hero Award of Ethiopia. In 2009, professor Gebissa Ejeta was awarded the world food prize, which is the most prestigiouse agricultural prize in the world.

4. Doctor Tewolde Berhan GebreEgziabher (The ardent lover of nature)

Dr . Tewolde Berhan GebreEgziabher is devoted to work in the following major areas :

- Exemplary work to safe guard the biodiversity.
- Traditional rights of farmers and communities
- Dr . Tewolde Berhan to their genetic resources also participated in various biodiversity meetings and negotiations some of these includes :

- Biodiversity related meeting such as, convention on Biological Diversity (C B D) and the food and agriculture organization .
- Chief nogotiation for on bio safety for like minded group (G - 77 countries)

For his massive contributions, Dr . Tewolde Berhan have won various international awards . Among these some of them are :

- The right lively award by the year 2000 . (Also called Alternative Nobel prize)
- United Nations top environmental prize, champions of the Earth in 2006.

5. **Professor Ensermu kelbessa** : is a systematic botanist who discovered and named various new plants.

6. **Professor Mogessie Ashenafi** : is an international researcher in to food micro biology.

7. **Professor Legesse Negash** : plant physiologist from Addis Ababa university has various contribution

- He is pioneers in propagation of Ethiopian Indigenous tree He is the founder and leader of center for indegeneous tree propagation and biodiversity development in Ethiopia

8. Professor Tilahun yilma

Prof . Tilahun Yilma is highly recognised for his vaccines against terrible cattle disease called Rinder pest. The vaccine is made through quite a modern technique called genetic engineering The vaccine is simply scratched on the neck or abdomen of cattle with out any form of injection.

Rinder pest arrived in Ethiopia in 1888, carried by the three infected cattle brought in to the country by Italian soldiers. With in a year 90 % of the domestic cattle plus many wild animals such as buffalo, giraffe and antelope died. As a result 30 - 60 % of the people of Ethiopia starved :

Professor . Tilahun also working for his work on HIV / AIDS Vaccines.

9. Dr . Melak Worede

Dr . Melak Worede is an Ethiopian plant genetic researcher. Among various contributions of him in relation to plant genetic resources of Ethiopia, **some of major ones are :**

- To save genetic diversity of Ethiopian domestic plant
- Preserved traditional crop varieties
- To worked on .how to get high yield of crops with out using Commercial fertilizers.

Dr . Melaku also worked as a chair of united Nations food and Agriculture organization commission on plant genetic resources for his works and contributions Dr .Melaku awarded :

- The Right Livelihood Award (often called the Alternative Nobel prize) in 1989.
- National Green Awarded Foundation for his out standing international contributions.

Conceptual Examples

42. Why is the establishment of biological research institutes are so important in Ethiopia ?

Explanation

Establishment of biological research institutes is so important in Ethiopian Because :

- It helps to up grade the standard of biological research.
- It helps to train highly skilled researchers and scientists
- To increase international partnership with other countries
- For the over all development of our country Ethiopia

43. Mention the main contributions of Dr . Melaku Worede, Ethiopian plant genetic researcher ?

Explanation

- Save genetic diversity of Ethiopian domestic plant
- Preservation of traditional group varieties
- To worked on how to get high yield of crops with out using Commericial fertilizers.

44. Why is professor Tilahun Yilma recognized highly ?

Explanation

Because of his vaccines against cattle disease called Rinder pest.

So, he developed rinder pest vaccination

45. Why is Professor Aklilu Lemmas work on the battle against bilharzias so important for most Africans ?

Explanation

Professor Aklilu Lemmas contribution is highly valuable for most African because before the discovery of Professor Aklilu soup berry The other molluscides in use were very expensive Thus. Dr .Aklilu's work soup berry is cheap and affordable by most Africans.

46. What makes the vaccine of Dr. Tilahun Yilma against find pest, so special ?

Explanation

The vaccine against terrible cattle disease rind pest which is made by Dr . Tilahun Yilma is so special because :

. It is made through a modern application of genetic engineering

. It is easy to use

47. Among the contributions of Dr . Melaku Worede list of three of them.

Explanation

Dr . Melaku worede is highly accredited for his works :

- To save genetic diversity of Ethiopia domestic plants
- To preserve traditional crope varities
- Ways of getting high yield of crops with out using commercial fertilizers

Illustrative Examples

48. Among the following list of renowned Ethiopian biologist which one is considered to be the pioneer ?

A. Professor Yealemtsehay mokonnen
B. Professor Aklilu Lemma
C. Dr . Tewoldeberhan G / Egziabhar
D. Dr . Gebissa Ejeta

Explanation

Professor Aklilu Lemma made a great contribution by making a soup berry which eradicates snails which are intermediate hosts of bilharzia in 1964.

Answer : B

49. Ethiopian Biologist who worked to increase the crop productivity of Ethiopia is :

A. Professor Beyene Petros
B. Dr . Gebissa Ejeta
C. Professor Aklilu Lemma
D. Professor Tilahun Yilma

Explanation

Dr . Gebssa Ejeta worked to develop strains of sorghum which are resistant to drought and resistant to striga weed He also introduced his works can increase the crop productivity of Ethiopia by ten times.

Answer : B

50. What is the role of soap berry of professor Aklilu Lemma in controlling bilharzias ?

A. Killing the bilharzias worms inside the body of human.
B. Eradication of snail which is an intermediate host for bilharzia.
C. Cleaning the clothes by the soup made from Endod.
D. Removal of stagnant water bodies where the snails breed.

Answer : B

51. Ethiopian biologist who is known for his vaccines against rind pest is

A. Dr . Tewolde Berhan G/ Egziabher
B. Professor Tilahun Yilma
C. Dr . Melaku Worede
D. Dr . Gebissa Ejeta

Explanation

Professor Tilahun Yilma is known for

- His vaccines against terrible cattle disease rind pest
- Works on the vaccines of H I V / A D S .

Answer : B

52. Ethiopian biologist who worked on the effect of chemical pesticides on human is

A. Professor Yealemtsehay Mekonnen
B. Professor Beyene Petros
C. Professor Tilahun Yilma
D. Dr . Melaku Worede

Explanation

Professor Yealemtsehay Mekonnen, who is the first female professor from A. A. U works on the following major areas :

- The effect of chemical pesticides on humans
- The use of plants for medicinal source.

Answer : A

53. When of the following Ethiopian biologist awarded the national Hero Award of Ethiopia ?

A. Professor sebsibie Demisew
B. Dr . zeresenay Alemseged
C. Dr. Tsehaynesh meselle
D. Dr . Gebissa Ejetta

Explanation

Dr . Gebissa Ejetta a warded the National Hero award of Ethiopia for his works on sorghum.

Answer : D

54. Ethiopia Evolutionist who discovered old human skulls which have a big impact on human evolution

A. Professor Legesse Negash
B. Professor Mogessie Ashenafi
C. Professor Ensermui kelbessa
D. Dr . Berhane Asfaw

Answer : D

55. Among the most renowned Ethiopian biologist who has been honored by developing high yielding strains of sorghum ?

A. Dr Aklilu Lemma
B. Professor Beyene Petros
C. Dr Gebissa Ejeta
D. Professor Tilahun Yilma

Answer : C

Explanation

Renowend Ethiopian biologist	Contribution
Professor Aklilu Lemma	He made a soup berry to eradicate snail, which is intermediate host for bilharzia.
Professor Beyene Petros	He is a biomedical scientist
Dr Gebissa Ejetta	Produced high yielding and drought resistant variety of sorghum
Professor Tilahun Yilma	Produced vaccine against terrible cattle disease called rind erpest.

End of unit Review Questions

Part I True / False Items

Say True if the Statement is correct and False if the Statement is incorrect

56. X - ray was discovered by Frederick Bating in 1895 .
57. Biochemistry deals with the chemical reactions that take place in living organisms.
58. Microscope was discovered by Theodor Schwann in 1838.
59. Genetics is a science that studies about heredity and variations.
60. The scientific contribution of Professor Gebissa Ejeta is on the application of Endod to control Bilharzia.
61. The scientific contribution of Professor Tilahun Yilma is on the application of genetic engineering to modifie sorghum crops.

Part II Matching Items

Match the description of field of study given column A with field of study given column B

A	B
62. The study of cells	A. Ornithology
63. The study of Insects	B. Ichthyology
64. Embryological development Of the fetus.	C. Entomology
65. The study of tissue	D. Micro biology
66. The study of microbes	E. Histology
67. The study of birds	F. Mycology
68. The study of fish	G. Embryology
69. The study of fungi	H. Cytology

Part III Multiple Choice Items

Choose the Best Answer From the Given Alternatives

70. The evolutionary history of an organism is known as:
A. Anatomy
C. Palaeontology
B. Ancestry
D. Phylogeny

71. Who discovered the circulatory system of blood
A. Ibn - Al - Naqis
C. Scottish naval
B. Mccollum
D. Edward Mellanby

72. The study of the internal structure of an organism is :
A. Morphology
C. Histology
B. Anatomy
D. Systematic

73. Anatomy is the study of
A. Life
C. Animals
B. Body parts
D. Ocean

74. Who is regarded as the father of genetics
A. Gregor Mendel
C. Scottish naval
B. Gebissa Ejeta
D. Eduward Mellanby

75. Who discovered the germ theory of disease
A. Louis Pasteur
B. Alexander Fleming
C. Frederick Banting
D. August Weismann

76. Who discovered Vitamines ?
A. Anton van Leeuwen hock
B. James watt
C. Frederick Hopkins
D. All of the above

77. Bilharzia is caused by
A. Snails
B. Bacteria
C. Parasitic flat worm
D. Viruses

78. What makes the soap berry of professor Aklilu Lemma advantageous over other molluscides ?
A. Its available in every drug store
B. Its relatively cheaper
C. It's quite a modern technology
D. Its supplied to every patient for tree

79. Morphology is the branch of biology which deals with :
A. The functions of internal structures of the body.
B. The internal structures of the body.
C. The classification of organisms.
D. The function of the external structures of the body.

80. A Biologist who is very popular for his discovers of cells is :
A. Antovan Leuwea Hock
B. Aristotle
C. Robert Koch
D. Robert Hooke

81. A Plant species from which professor Aklilu Lemma made a soap berry is
A. *Juniperus Procera*
B. *Rosa a bysinica*
C. *Phy tolecca dodecandra*
D. *Juniperus abysinica*

82. An Ethiopian biologist who is known as the ardent lover of nature is :
A. Dr Gebisa Ejeta
B. Dr Tewolde Berhan G/ Egziabher
C. Professor Yealmtsehay Mekonnen
D. Professor Tilahun Yilma

83. Ethiopian biologist who used a genetic engineering technology to develop vaccines is :
A. Professor Tilahun Yilma
B. Professor Yealemtsehay Mekonnen
C. Dr Melaku Worede
D. Dr Gebissa Ejeta

84. Ethiopian plant genetic researcher who worked to save genetic diversity of Ethiopia domestic plants is :
A. Professor Beyene Peteros
B. Dr Melaku Worede
C. Dr Gebissa Ejeta
D. Dr Zeresenay Alemseged

85. All of the following are correct about professor Beyene Petros **except**
A. He is a biomedical scientist
B. He published various articles
C. He won a gold medal a ward from Ethiopia Health Association.
D. He is currently working as a director of National Herbarium.

86. An Ethiopian Female scientist who write books and conducted research on human health issues, including HIV/AIDS is :
A. Perfessor Yealemtsehay Mekonnen
B. Dr Tsehaynesh Meselle
C. Dr Bogetch Gebre
D. None

87. Professor Mogessie Ashenafi is
A. A plant Physiologist
B. Food microbiologist
C. Human evolutionist
D. Biomedical scientist

88. A biological research institute which is considered to be a center for Biological research in Ethiopia is :
A. Ethiopia Institute for Agricultural research
B. AAU biology department
C. Armauer Hansen research institute
D. Institute of Biodiversity Conservation.

89. A renowned Ethiopian biologist who worked on increasing the productivity of sorghum is
A. Dr Aklilu Lemma
B. Professor Mogese Ashenafi
C. Professor Gebisa Ejeta
D. Professor Beyene Petros

90. Aklilu Lemma contributed in prevention of a disease called.
  A. Malaria
  B. Sleeping Sickness
  C. Bilharzia
  D. Marasmus

91. Vaccine against terrible cattle disease rind pest is produced by.
  A. Professor yealemtsehay Mekonnen
  B. Dr Aklilu Lemma
  C. Professor Tilahun Yilma
  D. Dr Birhane Asfaw

92. Ethiopia Paleontologist who discovered 3.3 million years old humanoid fossil is :
  A. Dr Zeresenay Alemseged
  B. Professor Tilahun Yilma
  C. Professor Hinsermu Kelbesa
  D. Professor Mogese Ashenafi

93. The use of indigenou plants to be used as a source of medicine is studied by :
  A. Dr Tsehaynesh Mesele
  B. Professor Yealemtsehay Mekonnen
  C. Professor Gebisa Ejeta
  D. Professor Tilahun Yilma

94. Ethiopian biomedical scientist who have publishe various journals and books is :
  A. Professor Beyene Petros
  B. Dr Teweldeberhan G/ Egzinabner
  C. Dr Zeresenay Alemeseged
  D. Professor Yealemtsenay Mekonnen

95. An indigenous plan that is used to produce a moluscide to eradicate snail which s the intermediate host of bilharzias is :
  A. Serbo
  B. Eucalyptus
  C. Endod
  D. Wanza

96. ___ Is well renowned for hi contribution on environmental protection.
  A. Professor Tilanun Yilma
  B. Professor Beyene Petros
  C. Dr Tewoldeberhan E /Egzihabher
  D. Professor Gebisa Ejeta

97. The first act of propagating Ethiopian indigenous trees is done by
  A. Professor Mogese Ashenafi
  B. Professor Yealemtsehay Mekonnen
  C. Professor Tlahun Yilma
  D. Professor Legese Negash

98. An Ethiopian genetic Engineer who researched on HIV / AIDS vaccine is
  A. Professor Yealemtsenay Mekonnen
  B. Dr Melaku Worede
  C. Dr Aklilu Lemma
  D. Professor Tiahun Yilma

Part IV Matching Items

Column A	Column B
99. Professor Tilahun Yilma	A. A biomedical scientist
100. Professor Yealemtsehay Mekonnen	B. Plant taxonomist
101. Professor Beyene Petros	C. Research on the use of plants as medicine against human and animal disease.
102. Professor Sebsbie Demisew	D. A plant genetic researcher
103. Dr melaku Worede	E. Workes on HIV/AIDS Vaccine

Part V Fill in the Blanks Spaces items

104. The first females Ethiopian professor from A. A . U. is ___

105. Scientific discoveries and articles of scientists are published in __

106. Professor Tilahun Yilma is highly recognized for his vaccines Against terrible cattle disease called _______

107. A systematic Ethiopian botanist who discovered and named various new plants is ________ .

108. Ethiopian institute which is working on an internationally recongni

Zed issue of biodiversity is ____

Answer keys

For End of units Review Questions

Part I True / False Items.

56. True
57. True
58. False
59. True
60. False
61. False

Part II Matching Items

62. H
63. C
64. G
65. E
66. D
67. A
68. B
69. F

Part III Multiple Choice Items

70. D
71. A
72. B
73. B
74. A
75. A
76. C
77. C
78. B
79. D
80. A
81. C
82. B
83. A
84. B
85. D
86. A
87. B
88. B
89. C
90. C
91. C
92. D
93. B
94. A
95. C
96. C
97. D
98. D

Part IV Matching Items

99. E
100. C
101. A
102. B
103. D

Part V Fill in the blanks spaces

104. Professor Alemtsehay Mekonnen
105. Journal
106. Rinder pest
107. Professor Ensermu Kelbessa
108. Per review

UNIT 8

Plants

8.1 Characterstics of Plants

What is Major Characterstics of Plants?

The Major Characterstics of Plants are:

i. Plants are living things

- Like all other living things plants can:
  - Reproduce
  - Grow
  - Irritability (respond to changes in the environment)
  - Respiration
  - Excretion
  - Nutrition
  - Movement

ii. Plants are multicellular

- Plants are made up of multicellular eukaryotic cells.

iii. Plants are eukaryotic cells:- Plants cells have well - defined nuclei and membrane - bound organelles.

- In addition to the cell membrane, plant cells have arigid cell wall made up of cellulose, large and permanent central vacuole.

iv. Plants are autotrophic (Self - feeding):- Plant cells contain the green pigment called chlorophyll in the chloroplast.

- Chlorophyll absorb sun light and produce their own food by the process of photosynthesis.
- Nutritionally, they are called autotrophs,/Producers/.

v. Plants practice asexual and sexual reproduction

- Asexual reproduction:- In lower plants such as mosses and liver worts, ferns asexual - reproduction by spores called sporulation.
- By vegetative propagation (reproduction) in higher plants is asexual reproduction.
- Sexual reproduction: in seed - bearing plants such as gymnosperms and angiosperms. sexual reproduction involves by the union of gametes (or sex cells).

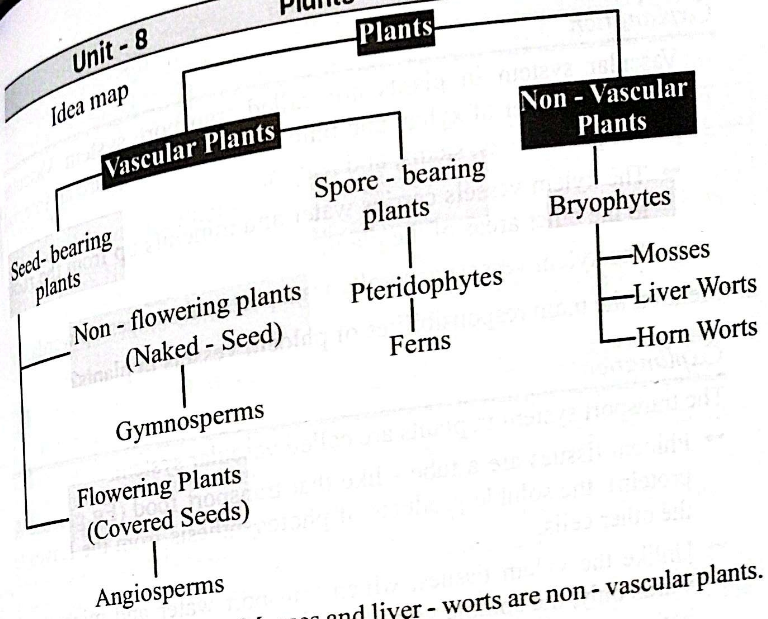
vi. Plants are sessile:- They can not move by themselves. They remain fixed at one place, firmly anchored to the soil by their roots.

However, growth movement of leaves and shoots towards light has taken place, some respond to touch, and also roots grow towards water or wet - soil takes place.

vii. Plants can also respire:- The process by which living organisms get the energy from their food cellular activities called respiration.

8.2 Flowering and Non - Flowering plants

Idea map



Non - Vascular plants:- Mosses and liver - worts are non - vascular plants. They are called bryophytes.

- They are small, non - vascular, land green plants.
- They have both stem and leaves but do not have roots.
- They live in wet or damp area or tree truks by hair - like cells that take up water.

Vascular plants:- are plants with tube like cells in roots, stems, and leaves. The tube like cells carry food and water throughout the plant.

There are two types of tube - like cells in vascular plants. These are: xylem cells and phleom cells.

- **Xylem tissues:** Carry water and dissolved minerals from the roots to the leaves.
- **Phleom tissues:** Carry food that is made in the leaves to all parts of plants.

Examples of vascular plants are ferns, gymno - sperms (non flowering plants) and angiosperms (flowering plants).

- Xylem and phleom tissues are called transporting tissues.

Conceptual Example

1. What is the responsibilities of xylem vessels in plants?

Explanation

Vascular system in plants are called transport system Vascular system consister of xylem and phloem tissues. They are an integral part of plants roots, stems, and leaves.

- The xylem vessels carries water and minerals up from the roots to the other areas of the plant.
- The xylem vessels generally transports substances up wards.

2. Mention the main responsibilites of phloem vessels in plants?

Explanation

The transport system in plants are called vascular system.

- Phloem tissues are a tube - like that transport food (Eg glucose & protein), the soluble products of photosynthesis from the leaves to the other cells.
- Unlike the xylem tissues, which transport water and minerals up wards only, the soluble goods from the leaves transported or move both up wards and down wards in the phloem.

3. Mention the major characterstics of plants?

Explanation

All plants are:

- Living things
- Eukaryotic cells
- Autotrophs (producers)
- Practic both sexual and asexual reproduction.
- Sessile (stationary or non-moveable)
- Can breathe and respire

4. Compare and contrast Gymnosperms and Angiosperms.

Table 8 . 1 Similarities and Differences Between Gymnosperms and Angiosperm

Gymnosperms	Angiosperms
☑ Non - flowering Plants ☑ Produce sperm in pollen ☑ Pollen and eggs are formed in cones. In male cone & female cone ☑ Produce seeds but have no flowers ☑ Seeds are naked - seeds. ☑ A seed has a hard outer covering ☑ Needle - like leaves ☑ Ever green - do not shade it's leaves both in winter and summer seasoons. ☑ They are vascular plants ☑ Have no ovary, fruits but have seeds ☑ Are huge plants used for timbur and paper. ☑ The are called coniferous plants.	☑ Flowering plants ☑ They are called seed - bearing flowering plants. ☑ Flower is the reproductive organ. ☑ The pistle of a flower produce egg cells and the stamen of the male produce pollen grain containg sperm. ☑ Pollen carried to the egg cells by pollinators. ☑ The female parts develop in to a fruit, covere or protect the seeds. ie seeds are with in the fruits. ☑ They are vascular plants. ☑ It includes from small herbs to large trees. ☑ Have diversified species.

8.3 Structure and Function of Plant Parts

8.3.1 The External Structure and Functions of Flowering Plants

The external structure of plants can be categorised in to two: They are shoot system and the root system.

The shoot system: is the plant parts found above the ground and includes the organs such as stem, leaves, flower, buds, branches and fruits. Flower and fruits may be missing depending on the reproductive stage of the plant.

The root system: is the parts of the plant found below the ground. It includes the organs such as tap root (Primary root), larteral (or branche) roots, root hairs and root cap.

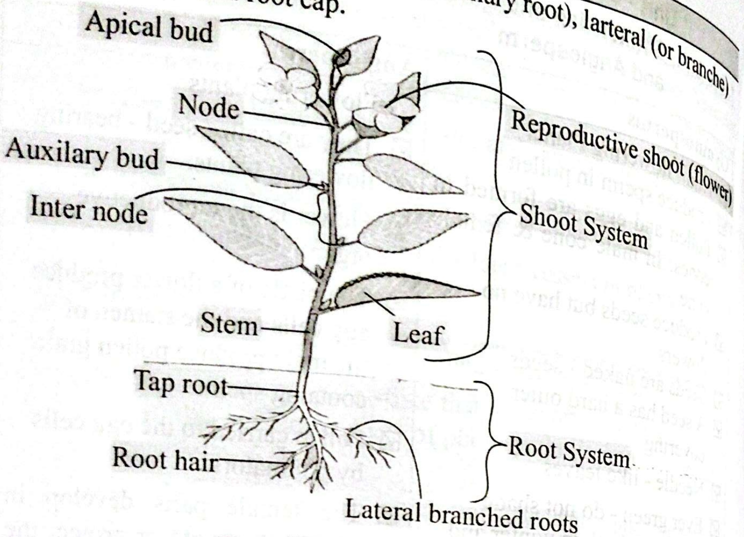


Fig 8.1 The Root and Shoot System of Plants

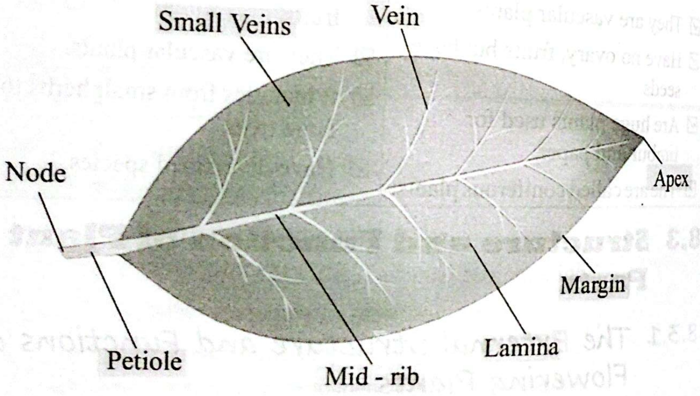


Fig 8.2 The External Structure of aleaf

The External Structure of a Leaf

i. **The stem:** has leaves at regular interval and a terminal bud at the growing points.

Node: The region on the stem from which the leaf develops is called node.

Inter node: The length of the stem between the nodes is called inter node.

☑ The stem can be erect, horizontal like runners, under ground as rhizomes, very short and never showing above the ground as in bulb; or long, thin and weak as in climbers.

ii. **Leaves:** Contain chlorophyll to carry out the process of photosynthesis. Food manufacured in the leaves.

- The external structure of a typical leaf consistes of the petiole, lamina, midrib, margin and apex.

The petiole: is a leaf stalk, that carries water & food to and from the leaf.

The lamina (blade): The broadest part, which is flat, wide and thin.

- It provides largest surface area which enable leaf to collect sun light.
- It's thinest create short distance for gas exchange through the stomata.

The mid - rib: continue from the petiole to the apex.

- It contains the vein (transporting vessecles) of the leaf and supportive tissues.

☑ Leaves of different plants are different in apsence or presence of petiole, leaf shape (margin) and arrangment of veins.

iii. **Root:-** There are two types of roots. Namely tap - root and fibrous (adventitious) roots.

Tap - root:- Tap - root consises of one large, primary - vertical root. It has few lateral roots that develops and grow this main root.

- It penetrates deep - in to the soil, tap- root. Provide ancore and absorb water and mineral ions.
- Tap - root systems is a feature of dicot plants

Fibrous root:- formed by thin, branching roots growing from stems.

- In grasses they develop as consistes of fine hairs, it spreads out from the base of the stem.
- It is very efficient to absorb water & mineral near the surface of soil.
- It holds soil together and good to protect from soil erossion.
- Flbrous roots are a feature of monocot plants.

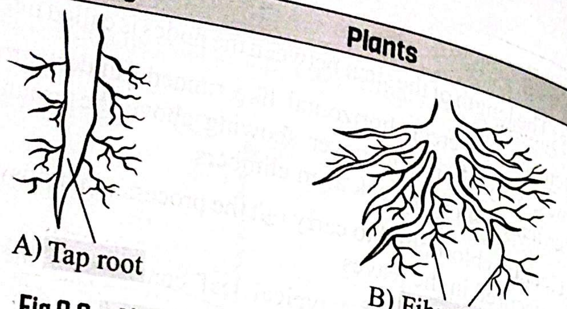

A) Tap root B) Fibrous roots

Fig 8.3 A) Tap - root and B) Fibrous roots

8.3.2 The Internal Structure of a Leaf

The internal structure of aleaf has two components. namely, outer layer and middle (inner) layer

A. The outer layer:- The outer layer of the internal structure of a leaf consistes of epidermis containing guard cells and stomata.

Epidermis:- The upper and the lower surfaces of the leaf are covered with a single layer of closely packed cells called epidermis.

➥ Except the guard cells it do not contain chlorophyll.

➥ The upper epidermis usually covered with a waxy cuticle, reduce the water loss called reduce transpiration.

➥ The lower epidermis of dicot leaves and both surface of monocot leaves contain specialized cells called guard cells.

Guard cells:- Which are epidermal cells with chloroplasts, surround microscopic pores called stomata (singular stoma).

➥ When the stomata are open, gas exchange and water loss occur.

B. The middle layer (Inner layer)

This is known as the messophyll (middle leaf) layer.

➥ It lies between the lower and upper epidermis.

The messophyll tissue has two distinct regions. They are:

➥ The palisade layer and spongy layer.

☑ The palisade layer: containing elongated, thin walled cells, arranged vertically against the upper epidermis.

➥ *It is in the best position to capture the sunlight to carry out photosynthesis.*

➥ *It contains the largest number of chloroplast per cell.*

➥ *It is the main site of photosynthesis.*

Spongy layer:- contain irregular loosely arranged cells bounded by air spaces.

➥ It contains fewer chloroplast to carry out photosynthesis.

➥ The leaf veins which contain vascular tissues (xylem and phleom tissues) are often found between the palisade and spongy layers.

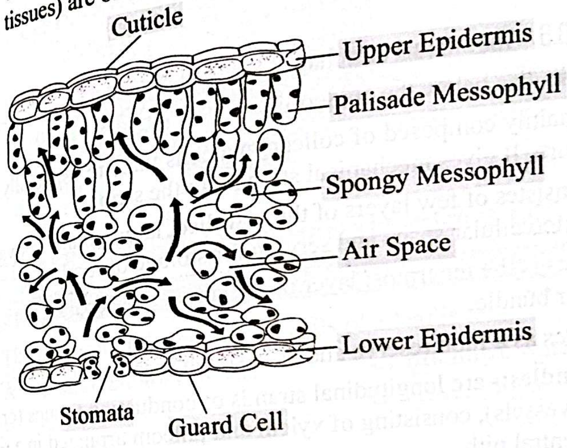


Fig 8.4 The internal structure of aleaf

8.3.3 The Internal Structure of a Stem

The epidermis is the outer layer of the stem. The outer walls are thickened with cuticles, which minimizes the rat of transpiration.

The cells are compactly arranged, which in turn protect underlying tissues from mechanical injury.

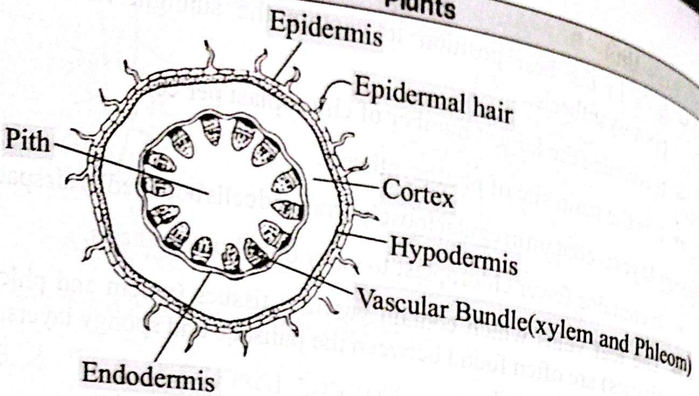


Fig 8.5 The internal structure of a typical dicot stem

Hypodermis:- lies below the epidermis.

- ➥ It is mainly composed of collencyma cells that are especially thick cellulose. It gives mechanical strength to the stem.

Cortex:- Consistes of few layers of thin - walled, large, round or oval cells, have intercellular space and serving for storage of food.

Endodermis:- is the innermost layer of the cortex that separate the cortex from vascular bundle.

- ➥ It serves as a food reserve and as a starch sheath.

Vascular bundles:- are longitudinal strands of conducting tissues (or transporting vessels), consisting of xylem and phleom arranged in a ring around the central pith.

- ☑ Phleom transport synthesized food, either for utilization or for storage.
- ☑ Xylem tissue transport water and dissolved minerals to the photosynthetic tissues, mainly to the leaves.

Pith: Occupies the central part of a stem, composed of thin walled cells.

- ➥ It stores food and help to internal translocation of water.

8.3.4 The Internal Structure of a Root

Piliferous layer:- is the outer most layer, made up of single layer cells.

- ➥ The cuticle is absent.
- ➥ It consistes of the single - celled root hairs.

Cortex:- is a multi layered large zone made of thin walled oval or rounded loosely arranged cells with intercellular spaces. It stores food and water

- ☑ **Vascular bundles:-** consistes of xylem and phleom with meristematic (Cambium) or actively dividing cells between them.
- ☑ **Pith:-** is present in young roots while absent in old roots.
- ☑ **Pericycle:-** is a single layer inner to endodermis.
  - ➥ It is the site of origin of lateral roots.

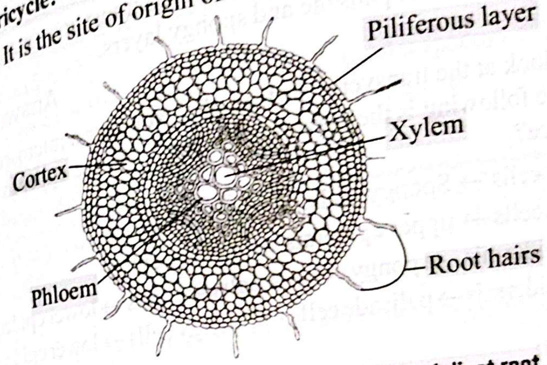


Fig 8.6 The internal structure of a typical dicot root

Illustrative Example

1. The function of the epidermal cells of a leaf is to:

A. Undergo photosynthesis
B. Stored food
C. Minimize water loss
D. Absorb light

Explanation

Epidermal cells contain waxy cuticles that prevents excessive loss of water by trans piration.

Answer: C

2. Which of the following plants cells do not photosynthesize?

A. Palisade cells
B. Pholem cells
C. Guard cells
D. Spongy cells

Explanation

Phloem cells do not contain Chlorophyll. Thus, they do not photosynthesize.

Answer: B

3. Mesophayll layer of a leaf has two distinct layers known as:
   A. Upper and lower epidermis
   B. Spongy and epidermis
   C. Palisade and spongy
   D. Palisade and air space

Explanation

Mesophyll layer is the middle portion of the transverse section of the leat. it consists of palisade and spongy layers.

Answer: C

4. When you look at the transverse section of aleat under a microscope, which of the following is the correct sequence, from the upper to the lower surface?
   A. Palisade cells → Spongy cells → upper epidermis
   B. Palisade cells → upper epidemis → spongy cells
   C. Upper epidermis → spongy cells → palisade cells → lower epidermis.
   D. Upper epidermis → palisade cells → Spongy cells → lower epidermis.

Explanation

The correct sequence of the transverse section of the leat from upper to lower is:

Upper epidermis → palisade cell → spongy cell → lower epidermis

Answer: D

5. The major gas exchange tissues of a plant reat are
   A. Spongy mesophyll
   B. Palisade mesophyll
   C. Stoma
   D. Vacovle

Explanation

Spongy cells are rounded cells that are arranged far apart from one another. They serve as gas exchange and photosynthetic layer in a leat.

Answer: A

6. Which of the following parts of a dicot plan treat contains the larfest number for CW or plalasts?
   A. Palisade layer
   B. Sponfy layer
   C. Epidermis
   D. Stomach

Explanation

The farfest number of chloroplast is found in palisade mesopnyll. Thus palisade cells are the most photosynthetic cells in a leat.

Answer: A

7. Which structure of a leaf prevents excessive loss of water from the leaf surfaces?
   A. Spongy water
   B. Palisade layer
   C. Air spaces
   D. Cuticle

Explanation

Waxy cuticle is structure that is found on the surface of upper epidermis. it prevents excessive loss of water from the leaf surfaces.

Answer: D

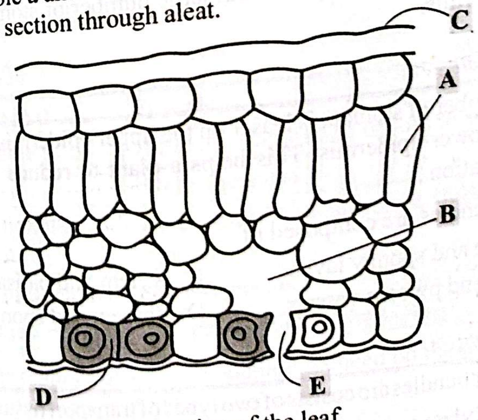
8. Which of the following parts of a laef is known as main vein?

Explanation

Midrib is a structure located on the external surface of the leaf. it is also known as the main vein.

Answer: B

Example a and 10 are based on the following diagrem representing across section through aleat.



Cross section of the leaf

9. Structure 'A' and 'B' represent, respectively.

A. Palisade layer and air spaces
B. Spongy layer and air spaces
C. Pouisade and air spaces
D. Spongy layer and chlorophyll

Answer: A

10. Structure 'D' and 'E' represent, respectively

A. Stomata and guard cell
B. Epidermal cell and stomata.
C. Waxy alticle and stomata.
D. Guard cell and stomata

Answer: D

11. The most dominant plants on earth at present are:

A. Lycophtes
B. Angios perms
C. Bryophtes
D. Gymonosperms

Explanation

The most dominant and diverse groups of plants on the earth are flowering plants or angios perms.

Answer: B

12. Why is the lower epidermis contain large number of stomata that the upper epidermis.

Explanation

The number of stomata is leaser on the upper epidermis as compared to the lower epidermis. This helps a plant to reduce ware loss by transpiration .

13. Vascular bundles are composed of

A. Palisade and spongy layer.
B. Xylem and pwoem vessels.
C. Xylem and palisade layer.
D. Phloem and spongy layer.

Explanation

Vascular bundles are cosists of two types of transport tissues These are:

- ➥ Xylem vessel
- ➥ Phloem vessel

14. Which of the following is different from the rest?

A. Palisade mesophyll
B. Apex
C. Vasallar bunles
D. Spongy mesophyll

Explanation

Apex is a part of the longitudinal (external) layer of a leat while, the rest are parts of the cross sectional (inner) layer of the leat.

Answer: B

15. Which one of the following is incorrectly matched with its function?

A. Palisade mesophyll - photosynthetic layer
B. Vascular bundle - transportation of substances
C. Waxy cuticle - increases transpiration rate.
D. Spongy mesophyll - serves as space.

Explanation

Waxy cuttle reduces or minimizes the rate of transpiration.

Answer: C

16. Describe the function of the following parts of a leaf

- ➥ Wany wticle
- ➥ Stomata
- ➥ Vascular bundles
- ➥ Palisade mesophyll
- ➥ Spongy mesophyll

Explanation

Parts of a leaf	Functions
Waxy cuticle	Prevents evaporation or loss of water
Stomata	Exchange gases
Vascular bundles	Transportation of substance (food water and mineral)
Palaside mesophyll	Photosynthesis
Spongy mesophyll	Air space photosynthesis

17. Why is the number of stomata opening reduced on the upper epidermis as compared to the lower epidermis?

Explanation

The number of stomata is reduced on the upper epidermis to reduce the loss of water by transpiration.

18. Why are palisaide cells, the most photosynthetic in the leaf

Explanation

Palisade cells are the most photosynthetic cells in a lest, because they contain the largest number of chloroplst.

Supplementary Exercises

Part I:- Choose the best answer from the given alternatives

19. Which one of the following is NOT the part of longitudinal section of aleat?
    A. Petiole
    B. Blade
    C. Epidermis
    D. Lamina
20. Structures on the upper epidermis of the leaf that prevents excessive evaporation of water is:
    A. Waxy cuticle
    B. Stomata
    C. Guard cell
    D. Chloroplast
21. Evaporation of water through the leaf of plants.
    A. Trans location
    B. Transpiration
    C. Conduction
    D. Convection
22. Larger number of stomata are found at:
    A. Lower surface of epidermis
    B. Upper surface of epidermis
    C. Evenly distributed through all parts of epidermis
    D. Not found at both surfaces.
23. The only cells of epidermis that contain chloroplasts are:
    A. Spongy cells
    B. Palisade cells
    C. Guard cells
    D. All
24. The most photosynthetic cells of a leaf are:
    A. Spongy cells
    B. Palisade cells
    C. Guard cells
    D. Vascular bundles
25. Spongy cells are
    A. Photosynthetic
    B. Air spaces in a leaf
    C. Parts of mesophyll
    D. All are answer

26. The role of vascular bundles in a leay is
    A. Absorption of light
    B. Evaporation
    C. Transportation of materials
    D. Splitting of water
27. All of the following are features of plants, except:
    A. Photosynthetic
    B. Eukaryotic
    C. Multicellular
    D. Heterotrophs.
28. Which are not photosynthetic in a leaf?
    A. Palisade cells
    B. Spongy cells
    C. Guard cells
    D. Xylem cells

Part II Match the following part of a lear with their function

A	B
29. Xylem tissue	A. Control the opening and closing of stomata.
30. Palisade cells	B. Serve as air space in the leat
31. Guard cells	C. Transportation of water and minerals
32. Waxy cuticle	D. Prevents excessive loss of water by transpiration
33. Spongy cells	E. The most photosynthetic layer in a leaf.

8.4 Reproduction In Plants

8.4.1 Reproductive Structure and Life Cycle of Non - flowering Plants

What are non - flowering plans?

Gymnosperms: are seed - bearing non - flowering plants>

Example *Juniperous procera* (Tid) *podocarpus* spp (zigba) and pine trees.

The Life Cycle of Gymnosperms

☑ **Cones:** are the reproductive organs of gymnosperms containing the male cone and the male cone on the same plant.

☑ Pollen transfered from the male cone to the female cone.

☑ The process of transfering pollen called pollination.

☑ Pollinating agent (or pollinator) is wind.

☑ Following pollination, the pollen complete its germination and produce the male gamete inside the female cone.

☑ The female gametes are also produced in the female cone. Here the male and female gametes unite and form azygote. This process is called. fertilization.

Zygote develops in to → seed - embryo → (inside the female cone) matured seeds released after opening the female cone.

☑ Dried seeds then scattered (or dispersed) a way from the parent plant and the seeds germinates in to a seedling (young conifer plants).

☑ The seeding (the young plant) develops in to a mature plant with female cone and male cone and the reproductive cycle of the conifer tree (pine tree for instance) is completed.

8.4.2 The Reproductive Structure and Life cycle of Flowering Plants

A flower is a reproductive organ of flowering plants. Angiosperms are flowering plants.

☑ Seeds in flowering plants are covered by a fruit.

Parts of A flower

Receptacle:- The enlarged tip of the stem that supports the flower is called receptacle.

Sepal (calyx):- Extending from the receptacle is an outer circle of modified leaves is called sepals.

- ➥ Sepal protect the developing flower bud.
- ➥ Often sepals are green and leaf - like.
- ➥ All the sepals together form the **calyx**.

Petals (corolla):- It attracts pollinators such as insects It is the coloured parts of a flower.

- ➥ Petal located inside the calyx.
- ➥ The petal form the **corolla** of the flower.

Stamens (Androecium):- Stamen produce pollen grains .

- ➥ Stamen produce pollen grains.
- ➥ Pollen grains are the powdery - like cells.

- The male gametes are called pollen grains. stamen has a slender stalk that holds anther at the top called filament.
- Anther is a sac - like that holds pollen grains in it. pollen grains formed inside the anther.
- Stamen consistes of bilobed anther (pollen grains in it) and filament.

Pistile or **(Gynoecium or carpel):-** The female reproductive organ of a flower is called pistil.

- It holds the inner most parts of a flower.
- Pistile consistes of stigma, style, ovary containing ovule inside.

Stigma:- The tip parts of the pistile is the stigma

- Stigma contain a sticky substance to hold or to adher the pollen grain when it dusts on its surface.

Style:- along, slendery - neck parts of the pistile that attached with the ovary is called style.

Ovary:- The large, swollen ovary that rests on the receptacle.

- Ovary contain ovule (one or two).
- Each ovule is covered by two tissue layers and is attached to the ovary wall by a stalk. Between the two covering tissue layers is a small opening is called the micropyle.

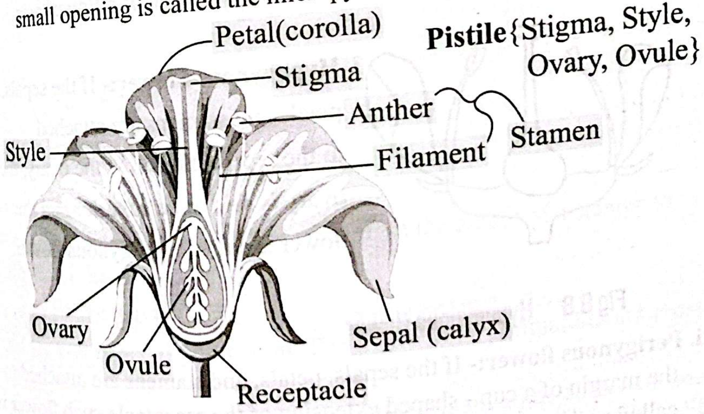


Fig 8.7 Structure of a Flowers

Each angiosperm has a distinctive flower.

Flowers vary in the number colour, shape, and arrarngement of the floral parts.

Types of flower

i. **Complete flower:-** has sepal, petal, stamen and pistile. Example coffee, rose, They contain the four floral parts.

ii. **Incomplete flower:-** A flower that lacks sepal or petals. Example grass, maize, teff.

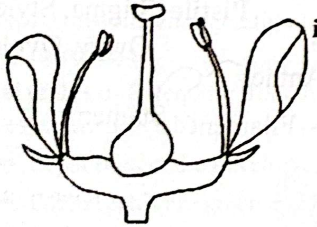
iii. **Perfect flower:-** A flower that contain both stamen and pistile.

iv. **Imperfect flower:-** A flower that contain either the stamen or the pistile but not both.

- They lack one of the two reproductive structure.
- In other words, stamen and pistile of a flower are on a separate plants. Example papaya.
- If it has only the pistile of a flower it is called pistilated.
- If it has only the stamen of a flower it is called staminated.

Differences in the position of the flower

Types of flowers showing differences in the position of a flower are:



i. **Hypogynous Flower:-** If the sepals, petals and stamens are attached to the receptacle below the ovary, the ovary is said to be superior and the flower is called hypogynous flower.

Fig 8.8 Hypogynous flower

ii. **Perigynous flower:-** If the sepals, petals, and stamens are attached to the margin of a cup - shaped extension of the receptacle such flower is called perigynous flower.

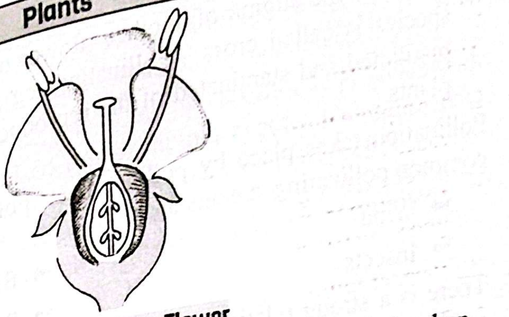


Fig 8.9 Perignous Flower

iii. **Epigynous flower:-** some flowers have inferior ovaries. This is when the sepal, petals and stamens are attached above the ovaries. such flowers is said to be epigynous flowers.

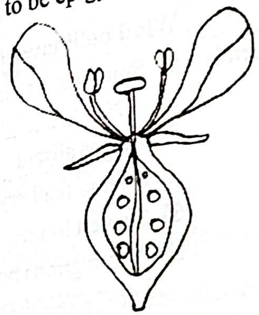


Fig 8.10 Epigynous flower

8.4.3 Pollination

What is pollination?

Pollination is the transfer of pollen grain from the anther of a stamen to the stigma of the pistile.

Types of pollination

There are two types of pollination. These are self - pollination and cross - pollination.

i. **Self - pollination:-** The transfer of pollen grain from anther of one flower to the stigma of the same flower of the same plant is called self - pollination.

ii. **Cross - pollination:-** The transfer of pollen grain from anther of one flower to the stigma of another flower of another plant of the same species is called cross - pollination. eg papaya plant flower, where pistillated and staminated of the reproductive parts are on a separate plants.

Pollination takes place by pollinators or pollinating a gents. The most common pollinating a gents are:

- ➥ Wind
- ➥ Insects
- ➥ Birds
- ➥ Rain water

There is a strong relation - ship between the nature of a flower and the pollinating a gents.

Table 8 . 2 Comparison between insect and Wind Pollinated Flower.

Insect pollinated	Wind pollinated flower
☑ Large, colourful, scented petals	☑ Small petals. lack colour and scent.
☑ Nectar present	☑ Nectar absent
☑ Stigma sticky, not feathery	☑ Stigma feathery, not sticky
☑ Stamen shorter	☑ Stamen longer
☑ Pollen grains sticky and smaller quantities.	☑ Pollen grains not sticky and larger quantities.

Pollen tube Formation

Following successful pollination, fertilization takes place. Fertilization is the process that fuse the male and female gamete nuclei together to form a zygote (a fertilized egg).

When pollen grains landing on the stigma, the stigma produce enzyme that stimulate only the right king of pollen grain to germinates pollen grain that has the same species allowed. This formation of tube along the style of the pistil down to the ovary is called pollen tube. An opening (hole) to the ovary is called micro pyle.

How dose the male gamete reach the female gamete and fertilizes it?

Enzymes in the stigma causes an extension of the cytoplasm to grow out of the pollen grain and form the pollen tube. The pollen tube pushes through the cells of the style of the pistil and grows towards the ovary. The tube nucleus is located at the point of the growing tube. The generative nucleus under goes mitosis, forming two haploid sperm nuclei As in the male gamete, meiosis also take place formation of eight nuclei. Passing through the pollen tube, one of the two sperm nuclei unites with the egg cell forming a fertilized egg or diploid zygote. The other male nucleus fuses with the secondary diploid nucleus (made up of two polar nucleus) and forms a triploid nucleus (3n).since the embryo sac, it is called as double fertilization. It is unique to flowering plants.

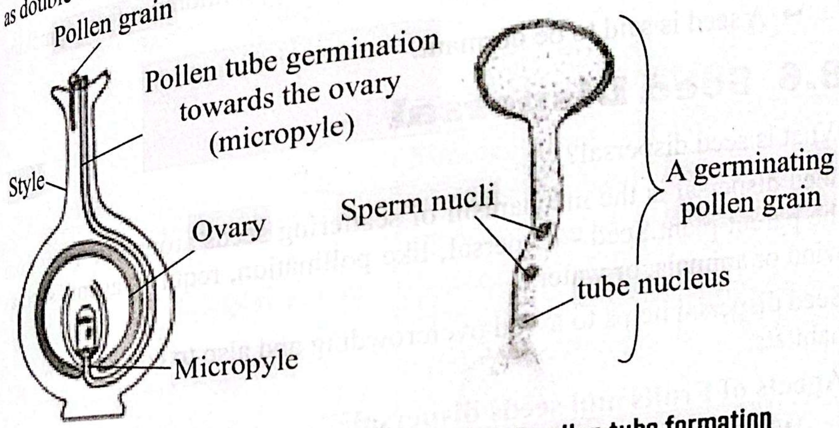

Pollen grain
Pollen tube germination towards the ovary (micropyle)
Style
Ovary
Sperm nuli
A germinating pollen grain
tube nucleus
Micropyle

Fig 8.11 Fertilization in flowering plants & pollen tube formation

8.5 Seeds and Fruits Formation

Shortly after fertilization, the sepals, petals, stigma and style all wither a ways and fall off. A coordinated growth and development of the zygote, endosperm nucleus, integuments and carpels take place.

The zygote develops in to an embryo, the primary endosperm nucleus also develop in to a seed - coat called **testa**, and the ovary wall and related structures develop in to a fruit.

After fertilization the ovule develops in to a seed containing the embryo, the cotyledon, the endosperm and seed coat.

Seed - coat: is called testa.

- ➥ Seeds enclosed by a seed - coat.
- ➥ It develops from the integument of the ovule.
- ➥ It provides protection for the enclosed seeds.

Ovary:- The ovary wall called **carpet**.

- Carpel is the wall of the fruits that encloses the seed.
- A fruit is called a ripened ovary.
- Ovary encloses the seeds.
- A matured ovary is called fruit.

Ovule:- A matured ovule is called seeds.

- Ovule matures in to seeds.
- When seeds formed, most of the water is withdrawn from it making it hard.
- A seed is said to be dormant.

8.6 Seed Dispersal

What is seed dispersal?

Seed dispersal is the mechanism of scattering seeds around or away from the parent plant.Seed - dispersal, like pollination, requires agents such as wind or animals, or water.

Seed dispersal helps to avoid overcrowding and also to colonise new habitats.

Agents of Fruits and seeds dispersal

i. **Wind dispersal:-** Seeds have wings, with hairs acts as a tiny parachutes have the extension of seed coat and fruit coat. contain hairy out grow.

- Example jacaranda and combretum (Abalo)

ii. **Animal dispersal:-** Succulent fruits which have fresh parts of fruits to be eaten by animals and the undigested seeds carried long distance and dropped on the ground with feaces to grow in to new seedling.
Example cherry.

- Some fruits have spines or hooks to cling on the surfaces of animals. Example: Triumfetta fruit (Nacha)

iii. **Water dispersed:-** fruits are buoyant. Example coconut, hard fruits wall carried by water and splitted up some where.

iv. **Self - dispersal:-** seed or fruit that disperse are explosive fruits.

- When their fruit wall (pod) dry, it splits in to two halves so that the seeds come out. **Examples** legumes.

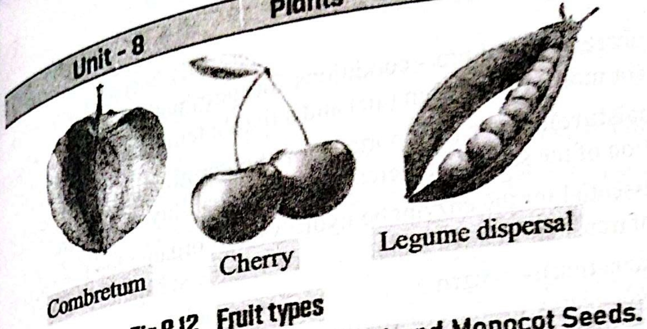


Fig 8.12 Fruit types

Table 8 . 3 Differences Between Dicot and Monocot Seeds.

Dicot Seed	Monocot Seed
☑ Two cotyledons are present in the embryo ☑ Cotyledon are fleshy and store food materials. ☑ Endosperm is absent ☑ Primary root (root tap) produced from the radicle bears many lateral roots.	☑ Only one cotyledon present ☑ Cotyledon is very thin & lacks food materials. ☑ Endosperm is large and well developed. ☑ Primary roots are formed from radicle is replaced by adventitious fibrous roots.

Germination of Seeds

The life of a flowering plant starts with dormant stage (a tiny seed embryo that stays dormant) until germination fulfilled ie. starts from dormant stage to germination stage.

The main function of the dormancy period is to allow seeds to germinates when conditions are suitable. The plant embryo survives in a dehydrated condition in the seed by becoming dormant. The seeds can survive very adverse conditions in a dormant stage.

Germination: The development of the embryo plant from the seed in to a seedling.

- Germination takes place after the period of dormancy when the essential conditions for active growth are fulfilled.

Conditions for seeds germination

The seed contains the embryo plant, food store and seed coat (testa). once the pre - conditions for germination fulfils the process of germination begins.

There are three essential pre - conditions for germination of seeds. These are water (or moisture), oxygen (air) and suitable temperature (warmth).

Water (moisture): water is important for the germinating seeds because the hydration of the seed coat increases its permeability to oxygen.

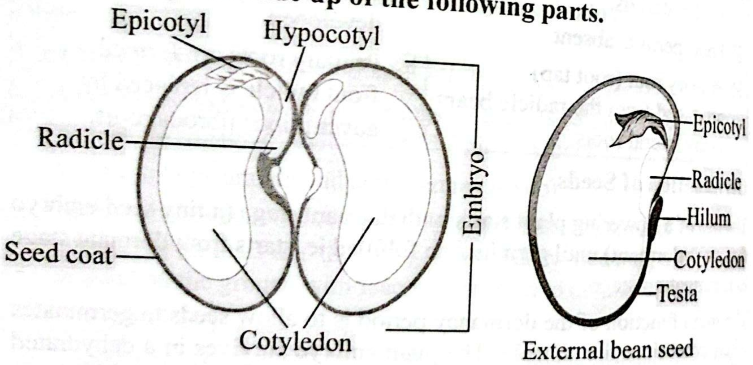
Water is essential for the enzymatic hydrolysis of organic food and acts as an agent of transport in the translocation of soluble substances.

Oxygen (aeration):- oxygen is necessary for aerobic respiration by which the seeds get energy for the growth of the embryo.

Suitable temperature: seeds requires optimum temperature (suitable temperature) for enzymatic action and for germination.

☑ The seedling must develop to become capable of obtaining water and minerals from the soil by root and carrying out photosynthetic leaves and become an independent plant.

A Seed embryo is made up of the following parts.



Dicot seed/bean seed /germination

Fig 8.13 Dicot seed/bean seed/ germination

Radicle: The first structure to emerge in the seed embryo is the radicle.

- Radicle is called an embryonic root which develops in to the root system down in to the soil.
- Once the radicle appeared the seed has germinated.
- Radicle is a sign of germination.
- The radicle develops from the hypocotyle.

Hypocotyle: is a stem - like area below the cotyledone which gives rise

to embryonic root (radicle)

Plumule: is the embroyonic shoot which develops in to the shoot system.

- Plumule develop from epicotyle.

Epicotyle: is the region above the cotyledon which gives rise to plumule.

Cotyledons: are seed leaves. monocots have one cotyledon & dicots have two cotyledons.

- In monocots seed food is stored in endosperm.
- Each type of seed has its own moisture and temperature requirement.
- Germination transforms the embryo in to a self supporting seedling.

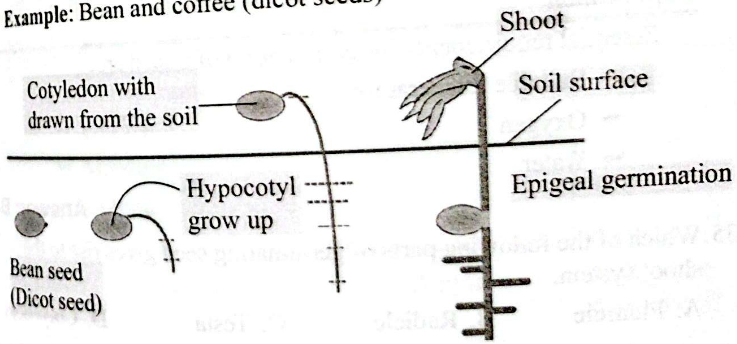
Coleoptile: shoot tip of young seedling.

Kinds of Germination

There are two different kings of germination. These are Epigeal and hypogeal germination.

i. **Epigeal Germination:-** a kind of germination in which the elongation of hypocotyl bringing the cotyledons above the ground or above the soil is called epigeal germination. Both the epicotyl and the hypocotyl emergs.

Example: Bean and coffee (dicot seeds)



ii. Hypogeal Germination

a kind of germination in which the elongation of epicotyl leaving the cotyledon below the ground.

Example corn seed (maize), wheat, sorghum (monocot seeds).

- Hypocotyl and radicle remains below the ground.

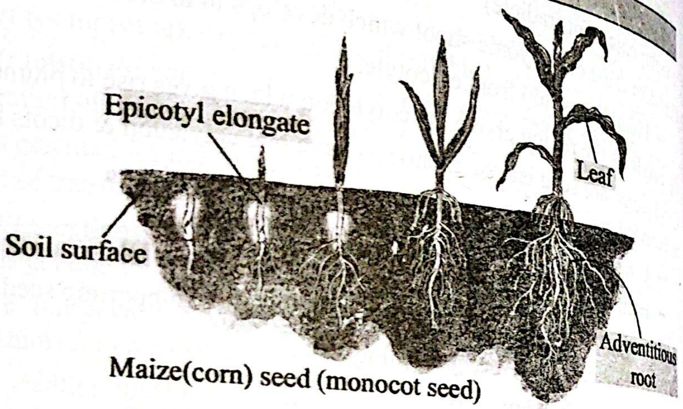


Fig 8.14 Hypogeal Germination

Illustrative Example

34. Which of the following is Not essential for germination of seed?

A. Suitable temperature
B. Light C. Oxygen D. Water

Explanation

Essential requirements for germination of a seed are:

- Suitable temperature
- Oxygen
- Water

Answer: B

35. Which of the following parts of germinating seed gives rise to the shoot system.

A. Plumule B. Radicle C. Testa D. Cotyledom

Explanation

Plumule develops in to the shoot system while radicle develops in to the root system.

Answer: B

36. Which of the following is correct about germinating seed?

A. Cotyledons begin photosynthesis
B. Cotyledons become shoot.
C. Plumule develops in to a root.
D. Embryo develop in to a seedling.

Answer: D

Explanation

Embryo of seed becomes a seedling which develops in to a plant.

37. In germination the embryo of a seed develops in to:

A. redicle B. Plumule C. Seedling D. Zygote

Answer: C

38. During germination of monocot seeds. the embryo obtains food from.

A. epicotyle B. testa C. Endosperm D. plumule

Explanation

In monocot seeds starch that is used for a source of food during germination is stored in the endosperm. while, the storage site of starch in dicot seed is cotyledon and endosperm.

Answer: C

39. List out the major requirements for seed germination.

Explanation

The main requirements for seed germination are:

- Oxygen
- Moisture
- Optimum temprature

40. An enzyme that converts starch in to sugar during germination is:

A. Lipase B. Maltase C. Amylase D. Diastase

Answer: D

Explanation

During germination of a seed enzymes that are:

- Lipase - converts stored fat in to fatty acid and glycerol.
- Diastase - to convert starch in to sugar.

Supplementary Exercises

Part III Choose the best answer from the given alternatives.

41. What is seed germination?

A. The process of planting seeds
B. The process of sees sprouting from seeds in to plants.
C. The process of harvesting seeds
D. The process of cleaning seeds out from fruits.

42. What are three of the main parts of a seed?

A. Seed coat, germination, leaves
B. Leaves, stem, cotyledon.
C. Seed coat, cotyledon, embryo
D. Cotyledon, embryo, soil.

43. What do seeds need to germinated?

A. Moisture, oxygen and low temperature
B. Moisture, oxygen and the right temperature
C. Moisture, oxygen and hight temperature
D. Moisture, nitrogen and right temperature

44. What is an endosperm?

A. It contains the male cell
B. It has small leaves that supply food to the embryo.
C. None of the choices mentioned
D. It contains the pollen.

45. What is inside a seed?

A. An embryo
B. Food
C. A small seed
D. Nutrients

46. In most species of plants, food is stored in

A. Radicle
B. Cotyledon
C. Plumule
D. Zygote

47. After the root has grown down wards, a small shoot grows up ward, to wards light. This shoot is known as

A. radicle
B. Plumule
C. Stem
D. Cotyledon

48. The types of germination on the basis of epicotyls and hypocotyls elongation are

A. epigeal germination
B. Hypogeal germination
C. epicotyls germination
D. both a and b

49. Through seed germination embryo develops in to

A. Complete plant
B. Zygote
C. Flower
D. Seedling

50. The external conditions on which the germination of seeds is dependent are

A. Sulficient food storage and water
B. live embryo
C. Sufficient food storage
D. Oxygen and water

51. A dicot seed has two cotyledons which:

A. Prepare food
B. Store food
C. Digest food
D. Seedling

52. The outer tough and hard covering of seed is called

A. Testa
B. Endosperm
C. Radical
D. Cotyledon

53. In side seed there is tiny plant is called

A. epicotyle
B. Endosperm
C. Embryo
D. Cotyledons

8.7 Photosynthesis

What is photosynthesis?

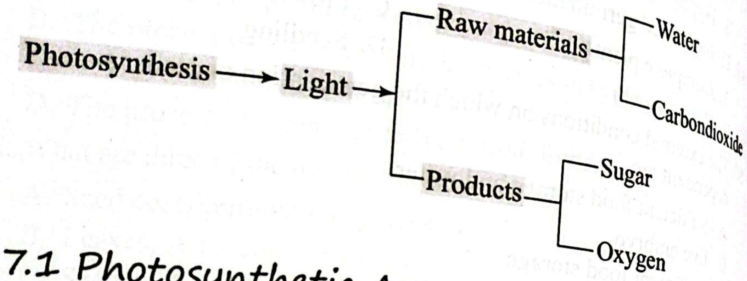
Photosynthesis is the process by which green plants make their own food by using CO_2 & H_2O in the presence of sun light traped by the chlorophyll

- Leaves of green plants are the food factories on earth.
- Green plants, algae and cyanobacteria (Bule green algae) can photosynthesis.
- Green plants and algae provides food that supports all life on earth. Thus, they are called producers or autotrophs (self - feeding). Herbivores (consumers) feed on plants.
- Sun light energy is the ultimate sources of energy for all living things on earth.
- Chloroplast contain a green pigment called chlorophyll, which capture sunlight energy to make food.
- Thus chlorophyll convert sunlight energy in to chemical energy

(food). This process is called photosynthesis.

Idea

How leaves make Food



8.7.1 Photosynthetic Apparatus

The photosynthetic apparatus is called chloroplast. Chloroplast contain chlorophyll located in the best position to - trap the maximum amounts of solar energy.

There are two distinct parts of chloroplast where photosynthetic reaction to takes place.

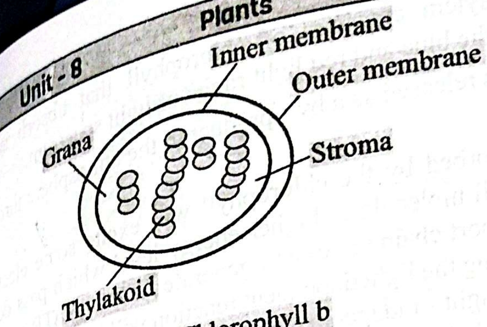
Granum and stroma.

8.7.2 The Light Absorbing System in Chloroplast

The chloroplast contains chlorophyll. Particularly chlorophyll a, chlorophyll b and carotinoids (accessory pigments). They are capable of absorbing light at different wave length. The light absorbing pigments of chloroplasts absorbs most of the visible light spectrum (ranging from 400nm to 700nm).

☑ Maximum light absorption occurs at wavelengths from 400nm - 500nm the blue light and 600 - 700nm the red light spectrum.

☑ The light ranging from 500 - 600nm is green light. Plants are green because the green spectrum is reflected, not absorbed.



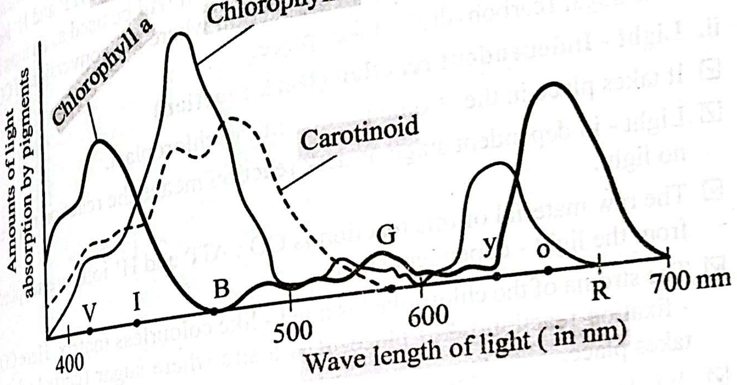


Fig 8.15 Absorption spectrum in chlorophyll

8.7.3 The Mechanism of Photosynthesis

Photosynthesists is consists of a number of photochemical and enzymatic reactions. Food manufactured process by photosynthesis is the sum total of the following two sub reaction.

i. **Light - dependent reactions (light reaction)**

☑ It takes place in the grana (plural) (granum, sing) portion of the chloroplast.

☑ Grana contain a stack of flattened sack called thylakoid.

☑ It is the main light absorbing system, the chlorophyll occurs.

Photolysis:- photo - means light, lysis - which means splitting. photolysis is the process of splitting up of water molecules by sun light energy in to hydrogen (H) & O_2

$$2H_2O \xrightarrow[\text{Captured by chloro}]{\text{Sunlight energy}} 4H + O_2 \uparrow$$

- ☑ The photosysytem consistes of chlorophyll that absorb sun light maximum at the blue and red light range of light spectrum.
- ☑ The oxygen is released as a by - product to the atmosphere through the leaf stomata.
- ☑ The light absorbed by the chlorophyll will excite some electrons in the chlorophyll molecule to higher energy level which pass down the electron transport chain (ETc) and generate ATP. The ATP and H^+ ions harvested during the light dependent reaction will be used as an input in the stroma of light - independent reaction where the conversion of CO_2 in to sugar (carbohydrate) takes place.

ii. Light - Independent reaction (Dark reaction)

- ☑ It takes place in the stroma portion of the chloroplast.
- ☑ Light - in dependent stage or dark reaction means the reaction requires no light.
- ☑ The raw material of this reaction is CO_2, ATP and H^+ ions are supplied from the light - dependent stage.
- ☑ The stroma of the chloroplast is a gel - like colourless matrix. Here CO_2 - fixation reaction takes place. It is a site where sugar (carbohydrate) takes place.
- ☑ It is from the sugar produced in the stroma that is directly or indirectly converted to all organic compound, such as amino acids, proteins and lipids.
- ☑ Light - Independent stage is called **carbon fixation or calvin - cycle.**
- ☑ Glucose (carbohydrate) is the immediate result of the dark reaction.

The over all photosynthetic reaction equation is:

$$6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{sunlight Energy}} C_6H_{12}\ O6 + 6O_2\uparrow$$

Carbon dioxide water glucose (or sugar) oxygen given off as aby- product

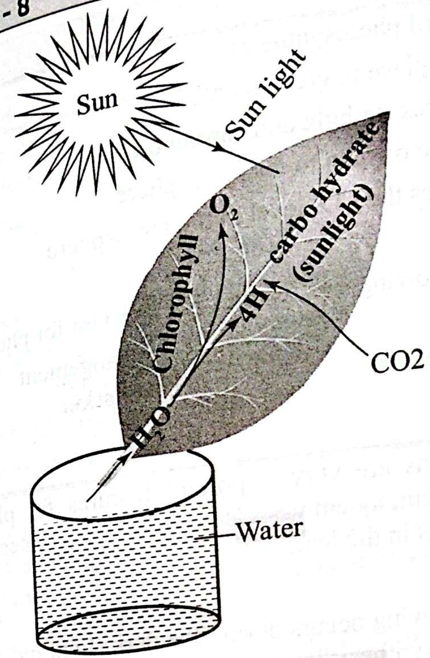


Fig 8.16 Photosynthesis in plants

Illustrative Example With explanatory note

54. The first stage of the reaction of photosynthesis does not involves

A. Light energy
B. Carbon dioxide
C. Water
D. Chlorophyll

Explanation

The first stage of photosynthesis is the light dependent stage and in involves light energy, wather and chrolophyll.

Answer: B

55. Which of the following is true about photosynthesis?

A. It takes places in green plants
B. It requires sunlight and oxygen
C. It releases carbon dioxide to atmosphere.
D. It reduces the level dioxide to atmosphere oxygen

Explanation

The process of photosynthesis

- Takes place in green plants
- Requires sunlight and carbon dioxide
- Release oxygen to the atmosphere
- Reduces the CO_2 level in the atmosphere

Answer: A

56. Which of the following leaf features is important for photosynthesis?

A. Margin
B. Size of petiole
C. Arrangement
D. Venation

Explanation

Leaf vennations are very important features for photosynthesis, because it contain xylem vessels through which water is supplied to the chloroplasts in the leaf.

Answer: D

57. Which of the following occurs during the dark (light independent) reactions of photosynthesis?

A. Splitting of water molecules in to hydrogen and oxygen.
B. Energy is stored in ATP and H^+ Ions.
C. Synthesis of glucose.
D. Absorption of light energy.

Explanation

The light independent stage of photosynthesis result in the synthesis of glucose.

$$6CO_2 + 24H^+ \rightarrow C_6H_{12}O6 + 6H_2O$$

Answer: C

58. During light reaction of photosynthesis, light energy is used primerily to:

A. Chemically combine carbon and oxygen
B. Chemically combine hydrogen and carbon dioxide
C. Split water in to hydrogen and oxygen
D. Split maltose in to glucose molecules.

Explanation

During the light dependent stage of photosynthesis light energy is used to split water molecule in to oxygen molecule and hydrogen ion.

$$12H_2O \xrightarrow[chllorophyll]{light} 60_2 + 24H^+$$

Answer: C

59. The two functions of the leaf as a photosynthetic organ are to:

A. Capture light energy and carbon dioxide
B. Capture carbon dioxide and oxygen
C. Capture light energy and water vapor
D. Release oxygen and carbon dioxide

Explanation

The leat as a photosynthetic organ captures light energy and carbon dioxide that are used during synthesis of glucose in photosynthesis.

Answer: A

60. The oxygen released by green plants during photosynthesis comes from the:

A. CO_2 molecule
B. Atmosphere O_2
C. H_2O molecule
D. Chlorophyll

Explanation

The oxygen that is release in to the atmosphere from the breakdown of water molecule.

$$12H_2O \xrightarrow[chlorphyll]{light} 60_2 + 24H^+$$

Answer: C

61. The role of chlorophyll in the process of photosynthesis is:

A. To capture carbondioxide and water
B. To capture carbondioxide
C. To capture sun light
D. To capture water

Explanation

Chlorophyll is pigmented substance that is found in the chloroplast of the leaf and is used to capture sunlight.

Answer: C

62. Plants give out CO_2 when its dark because:
   A. Leaves are respiring
   B. Leaves have excess CO_2
   C. There is excess CO_2 when it is dark
   D. No difference in CO_2 up take wheather dark or bright

Explanation

Plants give out CO_2 when its dark due to the reason that they are respiring.

Answer: A

63. The carbon and oxygen that are found in a glucose molecule produced by photosynthesis comes from.
   A. Chlorophyll
   B. Carbon monoxide
   C. Water
   D. Carbon dioxide

Explanation

Carbon dioxide is a source of carbon and oxygen that is found in a glucose molecule.

Answer: D

64. How do photosynthesis balance concentration of O_2 and CO_2? it
   A. Releases carbon dioxide and absorbs oxygen from the atmosphere.
   B. Oxidizes and removes carbon dioxide to from the atmosphere.
   C. Converts oxygen and absorbs carbon dioxide from the acid
   D. Releases oxygen and absorbs carbon dioxide from the atmosphere.

Explanation

During the process of photosynthesis organisms absorb carbon dioxide from the atoms phere and release oxygen gas to the atmosphere.

Answer: D

65. What is the role of chlorophyll in photosynthesis to absorb
   A. Light energy
   B. Carbon dioxide

   C. Water molecule
   D. Oxygen gas

Explanation

The role of chlorophyll in photosynthesis is to absorb light energy.

Answer: A

Supplementary Exercises

Part IV Multiple Choice

66. Which of the following organisms do NOT carry on photosynthesis?
   A. Plants B. Some bacteria C. Some algae D. Animals

67. Solar or radiant energy is involved in life because ______.
   A. Plants depend upon sunlight to synthesize food by photosynthesis.
   B. Plants bodies became fossil fuels
   C. Sunlight the earth's surface and provides the physical conditions for life
   D. All of the above are ways in which life is dependent up on the sun.

68. The correct description of the relation ship between photosynthesis and the living world is:
   A. Herbivores, carnivores and omnivores are autotroph since they can "eat for themselves".
   B. Heteratrophs are called "hetero" become they change sun light energy into chemical energy.
   C. All heterotrophy are ultimately dependent up on food produced by autotrophs.
   D. Herbivores are autotrophs, carnivores are heterotrophs and omnivores are half autotrophs and half hetrotrophs.

69. Plants and some algae carry on photosynthesis with in ______.
   A. Chloroplast
   B. Mitochondria
   C. Lysosome
   D. Golgi body

70. Thylakoids and grana are found with in organelles called ______.
   A. Ribosome
   B. Chloroplast
   C. Glogi body
   D. Lysosome

71. The ability of plants, algae and a few kinds of bacteria to make their own food in the presence of sunlight is called ______.

A. Respiration
B. Excretion
C. Photosynthesis
D. Germination

72. Which of the follower mole cules is produced during the light dependent reactions of photosynthesis and used in used in the light independent reaction.

A. Oxygen and glucose
B. Carbon dioxide, H^+ ions and ATP
C. Oxygen H^+ ions and ATP
D. ATP and H^+ ions

73. In which of the following steges of photosynthesis will water be splited?

A. Light dependent
B. Light independent

74. In which of the following stages will oxygen produced during photosynthesis?

A. Light independent
B. Light dependent
C. Dark reaction
D. None

75. Where in plants does most photosyntesis occur?

A. Flower
B. Leaf
C. Stem
D. Root

76. What is the starting source of the carbon in the glucose produced by photosynthesis?

A. Water
B. Chlorophyll
C. ATP
D. Carbon dioxide

8.7.4 Testing aleaf for Starch

☑ The glucose molecule produced by the process of photosynthesis is stored in the leaves temporarly in the form of starch.

☑ Glucose stored in the plants in the form of starch

☑ To check whether the leaf is photosynthsizing or not, it must be tested for the presence of starch. The steps used for starch test in a leaf are.

1. Put the leaf in a boiling water to kill the leaf.
2. Place the leaf in ethanol solution to remove the chlorophyll pigment (decolonrization).
3. Dip the decolourized leaf in to cold water to soften it.
4. Add iodine solution on the leaf. If the colour of the leaf turns blue black,

it shows the presence of starch in the leaf.

8.7.5 The Need for Chlorophyll

Chlorophyll is needed during photosynthesis to absorb sunlight which is used as the sources of energy. To demonstrate the need to chlorophyll during the process of photosynthesis. Take the following procedure

1. Take a plant with variegated leaves. variegated leaf is a leaf which is not completly green but has yellow or white strips.
2. Destarch a leaf by placing the plant in a dark place for 3 to 4 hours.
3. Place the plant in light only for few hours.
4. Take a leaf and test it for starch.

Result: Only the greenish part turns blue - black because it is photosynthesizing. How ever the variegated part that has no chlorophyll do not produce starch.

8.8 Transport in Plants

Green plants have photosynthesize their food from raw materials. But how water and minerals, move from root to leaves and how food manufactured from the rest of the plant? This is done by vascular bundles.

Vascular bundles: in plants are called xylem tissue and phleom tissues. They are called transport vessels in plants.

Xylem tissues: is a dead tissues

- ➥ It transports water and mineral ions from the root to the leaves.
- ➥ Water and mineral ions are transported through the dead tissue called xylem.

Phleom tissues: transport manufactured food from the leaves to the rest of the plant.

8.8.1 Transporting Systems in Plants

The two transporting vessels, xylem and phleom in the root. They are collectively known as vascular bundles. Water and minerals are transported from the root to the leaf via the stem through conducting vessels known as xylem.

Xylem consistes of elongated dead cells joined end to from continuous vessels. Phleom consistes of living cells arranged end to end allows

CS CamScanner

transport of food (sugar and amino acids) to the rest of the plant. This is called **translocation.**

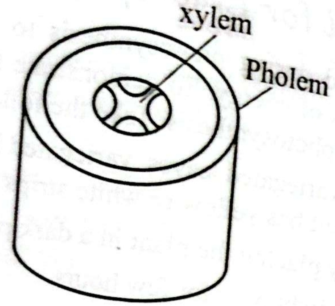


Fig 8.17 Vascular Bundle in Plant

Storage organs: plants sugar synthesized in the leaf in their storage organs. Stem of sugar cane, stem tuber of potato, seeds of plants,leaves of vegetables and fruits of plants are called storage organs. Sugar (glucose) synthesised, in the leaves are converted in to starch, and then starch stored in the storage organs. We take advantage of food in these storage organs. Starch from plants are a good sources of energy that we need in our diet.

8.8.2 Mechanism of Transport in Plants

i. Up - take of water and Minerals

☑ Water from the soil first enters through root hairs. Water enters the root hairs by diffusion and osmosis through xylem vessels.

☑ Xylem tissues are elongated single cells that provide a large surface area showing more water to enter in to the root.

☑ Mineral enter the root actively by active transport (with spending additional energy from the cell) through the xylem tissues from the soil

☑ This process of absorbing water and minerals enter the root is known as absorption.

Transpiration Pull:- water in the root xylem is pulled up wards passively. It is the evaporation from the leaves pulls water up wards from the root xylem through water conducting cells is called **transpiration pull**. This is pulling force caused by transpiration. During transpiration water that evaporates from the leaves is responsible to pull or drag water from the root along the stem through the xylem vessels.

Transpiration is the loss of water vapour from the surface of the plant (leaves).

This loss of water has the effect of pulling water up through the xylem.

Factors Affecting Transpiration

1. **Light:-** is the major effects on transpiration
   - Stomata open in the light (day time) for gas exchange, and close in the dark.
   - Thus, transpiration rate increase with light intensity.
2. **Temperature:-** is the next factor affecting transpiration.
   - An increase in temperature increases transpiration rate.
3. **Air movement (or wind):** Wind (or moving air) increase the rate of transpiration.
4. **Air Humidity**: is the concentration of water vapour in the air. a higher air humidity lowers the rate of transpiration.
5. The availability of water in the soil has an effect too.

Transpiration pull is assisted to pull or drag water from the root to the leaves through xylem vessels by a forces such as: cohesion, Adhesion, capiliarity and root pressure.

Cohesion force:- the attraction force between similar molecules. When water molecules leaves the xylem to enter the cell by osmosis this create a tension between water molecules in the xylem called cohesion.

Adhesion force:- The attraction force between unlike molecules (ie water molecules and the xylem vessels).

- The water molecules adhere strongly to the walls of the xylem vessels called adhesion force.

Capillarity: is the rise of water in a narrow fine tube (of the xylem vessels).

ii. Translocation of organic matter (food)

Translocation: in plants, transport of food from the site of synthesis (the leaves) to the site of utilization or storage organ (sink) is called translocation. Thus, it is the movements of food (organic substance) from the leaves to different parts of the plant.

Translocation occurs through the phloem.

Phloem: is a living cells

☑ Translocation through the phloem is an active transport (energy requiring process).

☑ The ringing or girdling experiment of the food conducting tissue called the phloem tissue helps to identify food manufactured in the leaves are transported through the phloem vessels.

☑ In this ringing or girdling experiment, swelling will be observed in the upper girdle. This is the accumulation of food materials (sugar) which are translocated from the leaves towards the root.

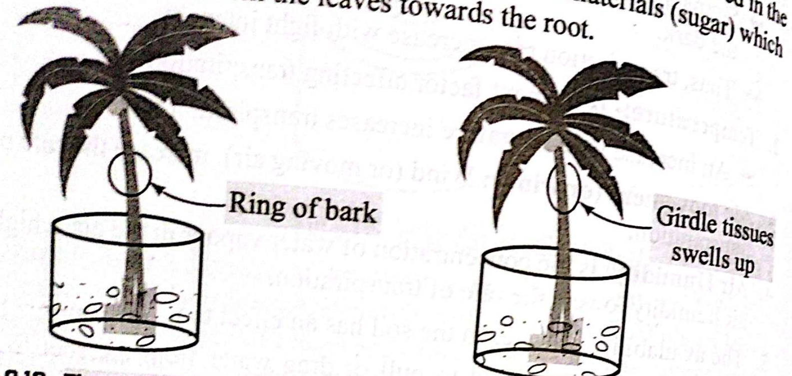


Fig 8.18 The ringing experiment of the food conducting tissues in plants

Conceptual Example

77. How cohesion and adhesion are different?

Explanation

Cohesion: is when the water molecules are stick to each other.

Adhesion: is the condition in which the water molecules adhere (stick) to the wall of the container or the capilliarity.

78. Plants must get water from their roots to there branches Explain how cohesion and adhesion helps plants get water from the ground to its upper leaves?

Explanation

Water moves up wards through xylem vessels when the leaves release water molecules in the form of water vapour, the other water molecules are attracted up wards continuosly. In the process the effects of cohesion and adhesion of water molecules are effective. The phenomenan are called transpiration pull.

Illustrative Example with explanatory Note

79. Which of the following factors reduce the rate of transpiration?

A. High temperature
B. Higher numidity
C. Light
D. Wind

Explanation

The rate of transpiration can be reduced by:

- ➥ Low temperature
- ➥ Higher humidity
- ➥ Less light intensity
- ➥ Steady air (less windy)
- ➥ Reduced number of stomata

Answer: B

80. In plants, water rises beyond the point supported by the atmospheric pressure mostly because of:

A. Capillarity
B. Gravity
C. Diffusion
D. Active transport

Explanation

Capillarity is the ability of water to rise in find tubes.

81. Up take of mineral ions from the soil into the plant is by:

A. Active transport
B. Osmosis
C. Transiocation
D. Plants transport

Explanation

Plants takes in minerals from the soil by active transport which requires expenditure of energy. This is due to the reason that; soil is less concentrated than the root's concentration. Accordingly minerals move against concentration gradient.

Answer: A

82. The rate of transpiration is high:

A. When the rate of evaporation is low
B. In cold humid condition
C. In rainy season
D. In dry and windy condition.

Explanation

The rate of transpiration is high when:

- The rate of the evaporation is high
- In warm and windy condition.
- In dry season

Answer: D

83. The rate of transpiration is inversely proportional to:

A. Temperature
B. Light intensity
C. Humidity
D. Air movement

Explanation

The rate of transpiration is inversely proportional to humidity. When the rate of transpiration increases, humidity decreases.

Answer: C

84. What do xylem vessels carry?

A. Water and mineral salts up stems from the roots.
B. Water and mineral salt down stems to the roots.
C. Dissolved sugars up stems from the roots.
D. Dissolved sugars down stems to roots.

Explanation

Xylem vessels are used to carry to transport water and mineral ions up the stem from the root.

Answer: A

85. Which of the following is responsible for absorbing water from the soil?

A. Phloem
B. Cortex
C. Xylem
D. Root hair

Explanation

Water is absorbed from the soil by structures on the root known as root hairs.

Answer: D

86. Girdling of a tree by completely removing a ring of bark most affects the process of

A. Translocation
B. Transpiration
C. Photosynthesis
D. Cellular respiration

Explanation

Gridling of a tree bark causes the removal of pholem tissue. This affects the transportation of food (organics) substances which is called translocation.

Answer: A

87. The main factor responsible for the movement of water from the roots to the leaf parts of the tallest tree is the.

A. Hight pressure near the roots
B. Strength of xylem cells
C. Transpiration pull
D. Concentration of water in the soil.

Answer: C

Explanation

There are several factors that are responsible for the movement of water along xylem vessel. How ever the main factor is transpiration pull.

88. Plants transpire through

A. The lower surfaces of the leaf only
B. The upper surfaces of the leaves only
C. The lower or upper or both surfaces of the leaves.
D. None of the above

Explanation

Plants mainly transpire through the lower surface of the leaf. This is because the largest number of stomata opening through which transpiration takes place is the lower surface of the leaf.

Answer: A

89. The inner most part of a root is occupied by:

A. Cambium
B. Phloem cells
C. Pith cells
D. Xylem cells
E. Endodermal cells

Answer: C

90. What is capillarity? it is the

A. Osmotic up take of water in to roots from soil
B. Force of attraction between water molecules and the surface of xylem.
C. Rising up of water molecule in narrow tube
D. Force of attraction between water in narrow fine tubes.

Answer: C

91. Transpiration in plants is high in

A. Windy condition
B. Wet condition
C. Humid condition
D. Cold condition

Explanation

Transpiration is high in

- Windy condition
- Warmer and high temperature
- Dry condition

Answer: A

92. What is the impact of transpiration in agricultural plants?

A. Higher transpiration rate increases the chance of growth of agricultural plants.
B. Higher transpiration rate increases the chance of agricultural plant wilting.
C. Very low transpiration increases growth of agricultural plants
D. Higher transpiration increases the activities of agricultural plants cells.

Explanation

Higher rate of transpiration may cause shortage of water, which may lead the plants to wilting.

Answer: B

93. Water up take by roots is facilitated by:

A. Active transport of water molecules
B. High concentration of water in the roots
C. The large vacuoles in the roots and leaves

D. High surface area of root hairs

Explanation

Root hairs have increased surface area to absorb more water by the process of osmosis.

Answer: D

94. List out the forces that assist the transpiration pull.

Explanation

Transpiration pull is the main factor resposible for the movement of water along the stem through xylem vessel it is assisted by forces such as:

- Adhesion
- Transpiration
- Translocation
- Capilarity

95. Define the following

- Adhesion
- Transpiration
- Translocation
- Capilarty

Explanation

- **Adhesion:-** is the attraction force between water molecule and xylem vessel.
- **Transpiration:-** is the evaporation of water form a plant mainly through the leaf stomata.
- **Translocation:-** is the movement of food (organic substance) from the leaf to different part of a plant.
- **Capillarity:-** is the rise of water in narrow fine tube.

96. Oxygen is the bi product of photosynthesis Experimental results shows that it originates from:

A. Water
B. Carbon di oxide
C. Carbon hydrate
D. Sun light

Explanation

Oxygen which is the bi - product of photosynthesis originates from the oxygen in water molecules.

Answer: A

97. Which of the following is true concerning the light independent stage of photosynthesis?

A. Carbon dioxide and hydrogen are combined to form glucose.
B. Water molecules are split to hydrogen and oxygen.
C. Formation of NADPH and ATP.
D. It occurs in the grana of the chloroplast

Explanation

Ouring the light independent stage of photosynthesis carbon dioxide and hydrogen are combined to form glucose.

Answer: A

98. During which stages of photosynthesis is oxygen produced?

A. Cyclic photo phosphorilation
B. The light dependent reactions.
C. Carbon fixation.
D. The light indendent stage of photosynthesis.

Explanation

Oxygen is produced during the light dependent stage of photosynthesis

Answer: B

99. The light dependent photosynthetic reaction produces:

A. Energy, hydrogen and oxygen.
B. Glucose and carbon dioxide
C. Glucose and carbon dioxide
D. Hydrogen water and carbon dioxide

Explanation

The light dependent stage of photosynthesis produces:

- Energy
- Hydrogen
- Oxygen

100. What are the major requirements of photosynthesis?

Explanation

The major requirements or needs of photosynthesize are:

- Sunlight
- Chlorphyl
- Water
- Carbon dioxide

101. Explain the role of water during the process of photosynthesis

Explanation

The role of water is photosynthesis is it serves as source of hydrogen ion found in a glucose molecule.

102. What is the relationship between photosynthesis and respiration?

Explanation

During photosynthesis carbon dioxide is utilized and oxygen is released while, during respiration oxygen is utilized and carbon dioxide is relased. the bi product of photosynthesis is needed during respiration and vice versa.

103. Write the chemical reaction of

- Light dependent reaction
- Light independent reaction
- Overall reaction of photosynthesis.

Explanation

- The chemical reaction during light dependent reaction is

$$12\,H_2\,O \xrightarrow[\text{Chlorophyll}]{\text{Sun light}} 60_2 + 24\,H^+$$

- The chemical reaction during light independent reaction is

$$24\,H^+ + 6CO_2 \rightarrow C_6\,H_{12}\,O_6 + 6H_2O$$

- The overall reaction of photosynthesis is the combination of the above two reactions:

$$6H_2\,O + 6CO_2 \xrightarrow[\text{Chlorophyll}]{\text{Sun light}} C_6\,H_{12}\,O_6 + 60_2$$

104. Which one of the following is NOT the requirement of photosynthesis?

A. Oxygen
B. Carbon dioxide

C. Water
D. Sun light

Explanation

Carbon dioxide water, sun light and chlorophyll are the requirements or needs of photosynthesis, while oxygen is the bi - product of synthesis.

Answer: A

105. How do plants absorb mineral ions?
   A. By the action of enzymes as carriers
   B. Without used the action of enzymes
   C. By using energy from the plant
   D. Without using energy from the plant

Explanation

Plant roots absorb mineral by the process of active transport which requires expenditure of energy.

Answer: C

106. Which of the following transport process take place in the phloem? The movement of:
   A. Organic substance from the leaves to other parts
   B. Water from soil to the roots.
   C. Minerals from the roots to the leaves
   D. CO_2 from the air to the palisade mesophyll

Explanation

Phloem tissues are used to transport organic substance /Food/ From the leaf to different parts of the plants. The process is called translocation.

Answer: A

Supplementary Exercises

Part III Choose the best answer from the given alternatives.

107. Transportation of substances such as water and minerals in plants takes place through.
   A. Root hair
   B. Xylem vessel

   C. Phloem vessel
   D. Capillarty tube

108. Absorption of water by root hair cells from the soil occurs by the process of
   A. Osmosis
   B. Active transport
   C. Diffusion
   D. Passive transport

109. In plants the largest amount of water that absorbed from the soil is evaporated through the leaf. The process is called.
   A. Transport formation
   B. Translocation
   C. Transpiration
   D. Absorbtion

110. The role of phloem in plants is:
   A. To transport water from the root to different parts of the plant.
   B. To transport starch from the leaf to parts of a plant
   C. To carry minerals along different parts of a plant.
   D. To remove excessive organic substances from a plant.

111. The absorption of minerals ions from the soil occurs:
   A. Against concentration gradient
   B. Requires the concentration gradient
   C. Requires expenditure of energy
   D. B and C are correct.

112. The movement of organic substance from the leaf to different parts of a plant is:
   A. Translocation
   B. Transpiration
   C. Capillarity
   D. Root pressure

113. Which of the following is a passive transport?
   A. Absorption of water by root hair from the soil.
   B. Absorption of mineral by the root from the soil.
   C. Translocation.
   D. An are possible answers.

114. The rise of water in fine tube is known as:
   A. Adhesion
   B. Capillarity
   C. Cohesion
   D. Transpiration

115. Which of the following is **not** responsible for the movement of water along the height of the stem?
   A. Capillarity
   B. Root pressure

CS CamScanner

C. Cohesion

D. Transpiration pull

116. The major force responsible for the movement of water along the stem though xylem vessel is:

A. Cohesion

B. Transpiration pull

C. Adhesion

D. Capillarity

8.9 Response in Plants

What is response?

Response is the reaction given by the plant (the organism) towards the stimuli.

- Plants respond to changes in the environment (stimli).
- Plants like other living things share basic charactertics of life. one of the basic charactersticter of life is respond to the stimui (changes in the environment) is called irritability.
- Plants do not have nervous system. But they do have hormonal system.
- The response in plants are called growth response. The growth response in plants are called tropism.

8.9.1 Tropism as Growth Response

There are 5 types of tropism. These tropisms are:-

- Phototropism
- Hydrotropism
- Chemotropism
- Geotropism
- Thigmotropism

Phototropism: The growth response of shoots towards unilateral light is called phototropism.

- It is directional growth movement in response to light.
- Shoots grow towards the uni lateral light.
- Shoots are called positively phototropism.
- Roots grow away from light
- Roots are called negatively phototropism.
- Shoots grow away from gravity.

- Shoots are called negatively geotropism.

The earliest experiment on phototropism was conducted by charles Darwin C. Darwin (18 -) was called the father of evelution.

He noticed that if the light is shone on a coleoptile from one side (unilateral light) the shoot bends or curved to grow towards the unilateral light. The bending did not occur in the tip (coleoptile) it self but in the elongating part just below it.

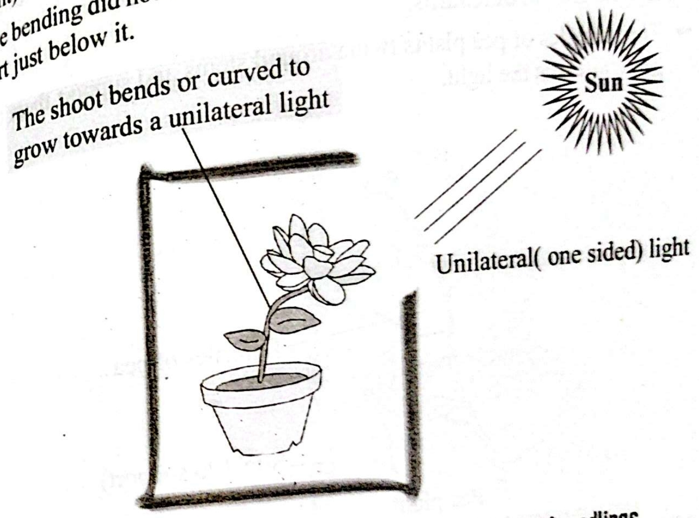

The shoot bends or curved to grow towards a unilateral light
Sun
Unilateral(one sided) light

Fig 8.19 Effects of unilateral light on the growth of seedlings

☑ The unilateral light causes to shift the auxin concentration to the dark side (shaded region), where rapid cell division and cell elongation occurs.

☑ Growth is rapid at the dark (shade) region causes to bend and curved to grow towards the light side.

Geotropism: The growth response of plants towards gravity is called geotropism.

- Roots grow towards the soil (ground).
- Roots are positively geotropism.
- Roots grow away from light.
- Roots are negatively phototropism.

Hydrotropism: The growth response of plants towards water is called hydrotropism.

- Roots grow towards most soil or water.
- Roots are positively hydrotropism.

Thigmotropism:- The growth response of plants toward contact or touch.

- Plants shoots respond to grow towards contact or touch is called thigmotropism.
- Eg. the growth of tendrils.
- The tendriles of pea plants twine around stems and support them to grow towards the light.

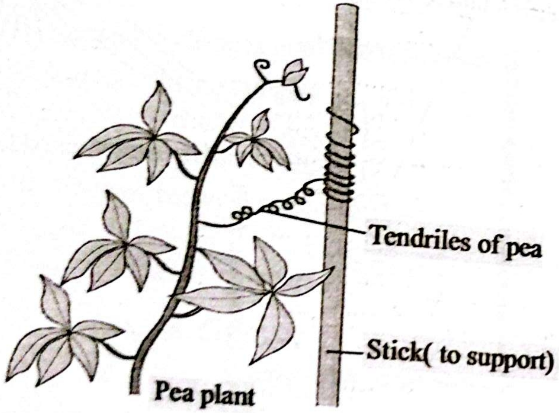


Fig 8.20 Thigmotropism the growth of terndriles of plants around the stick

Chemotropism: is a growth response of plants to the stimulus of chemicals.

- Example A pollen tube grow toawards chemicals produced the micropyle. (or opening to the ovary).
- It is positively chemotropic

Tropism is exhibited by the shoot and root of a plant due to unequal concentration of growth hormone, commonly called Auxin (IAA), resulting in unequal growth.

What controls plant Growth and Development?

Experiments suggest that plant hormones control the growth of shoots and roots. They may promote or inhibit a process. There are five types of plant growth hormones. These are Auxin (IAA - Indol acetic acid), cytokinin, gibberllic acid, ethylene and Abscesic acids.

Table 8 . 4 Functions and locations of the major plant hormones.

	Hormones	Major Functions	Where produced Plants?
1	Auxin (IAA - the principal natuarlly occurring auxin in plant)	☑ Promotion of stem elongation and growth, ☑ Formation of adventitious roots ☑ Inhibition of leaf obscission ☑ Promotion of cell division (with cytokiness) ☑ Inducement of ethylene production. ☑ Promotion of lateral bud dormancy	☑ Apical meristems ☑ Other immature parts of plants
2	Cytok inins	☑ Stimulation of cell division, but only in the presence of auxins and gibberellins ☑ Promotion of chloroplast development ☑ Delay of leaf aging	☑ Root apical meristems ☑ Immature fruits
3	Gibberellic acid	☑ Promotion of bud formation. ☑ Promotion of stem elongation ☑ Stimulation enzyme production in germination seeds.	☑ Roots and shoots tips ☑ Young leaves ☑ Seeds

4	Ethylene	☑ Control of leaf, flower and fruit abscission. ☑ Promotion of fruit ripening	☑ Roots, shoot apical meristems; ☑ leaf nodes ☑ Aging flowers ☑ Ripening fruits
5	Abscisic Acid	☑ Inhibition of bud growth ☑ Control of stomatal closure ☑ Some control of seed dormancy. ☑ Inhibition of effects of other hormones.	☑ Leaves, fruits, roots caps, seeds.

Auxin (Indol acetic acid), is a plant growth hormone.

- ☑ Auxin is produced at the tip of shoots and roots.
- ☑ Shoot and root tips are rapidely divided cells called the meristematic cells and tissues causing the cells below the tips to elongate.
- ☑ Auxin promote elongation and growth of stem & roots.
- ☑ If the growth movement takes place towards the stimuli it is called positive tropism, and if the growth movement takes place away from, the stimulus it is called negative tropism.

When a shoot tip is exposed to a unilateral light, the auxin secreted at the tip of shoot redistributed and shifted towards the dark side, stimulating faster growth than the illuminated side.

Shoots and roots respond differently to different auxin concentration. auxin concentration in general required in very small amount for the growth and development of both shoots and roots.

The effect of auxins on growth depends on their concentration. auxin concentration which stimulate the growth of the root (10^{-4} ppm) does not affect the shoot. On the other hand, the auxin concentration which promotes (stimulates) growth of the shoot (10^{-2} to 101 ppm) in hibits the growth of the root.

➥ Very less amount of auxin is required by the root than the shoot.

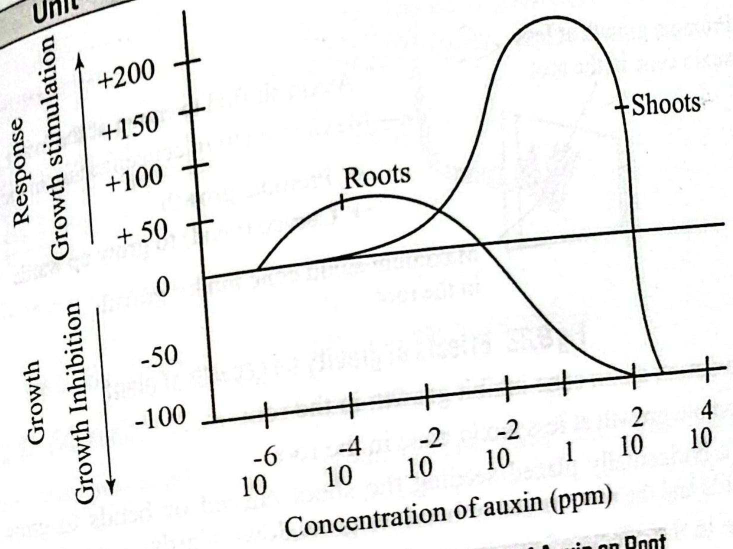


Fig 8.21 Effects of Different Concentration of Auxin on Root

Effects of Removing Apical Dominance on the Developments of plants.

What is apical dominance?

Apical dominance is a hormone which are found in the tip parts of a shoots inhibit the growth of lateral branches. This action of the hormones is called **apical dominance.**

Removing the apical dominance encourage the developments of lateral branches is called **pruning.**

Pruning helps to pick seeds and fruits easily, to get a strong frame works of branches capable of supporting heavy loads of fruits and seeds, and increase the production of abundant flowers.

Example: Coffee plants, juniper (Tid) plants.

Effects of gravity in a horizontally Placed Seedling.

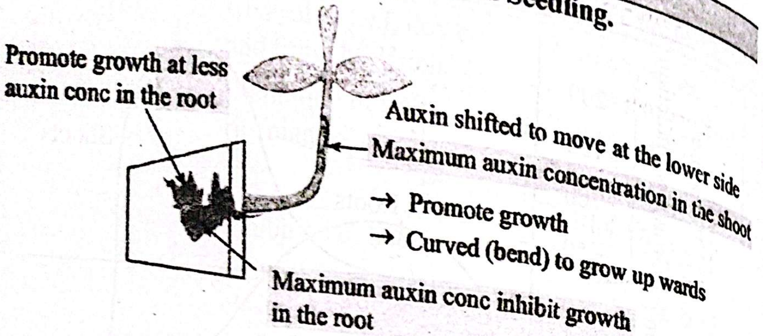

Promote growth at less auxin conc in the root
Auxin shifted to move at the lower side
Maximum auxin concentration in the shoot
→ Promote growth
→ Curved (bend) to grow up wards
Maximum auxin conc inhibit growth in the root

Fig 8.22 Effects of gravity on growth of plant

Maximum auxin conc inhibit growth in the root

Promote growth at less auxin conc in the root

In a horizontally placed seeding the shoot curved or bends to grow up wards and the root curved or bends to grow down wards.

Due to the effects of gravity, auxin (IAA) redistributed and shifted from the tip (shoot tip & root tip) and concentrated at the lower side of the shoot and the root.

In the shoot : Auxin concentration shifted to move at the lower side. causing (promoting) the shoot to bend or curved to grow up wards.

In the root: Auxin concentration shifted to move at the lower side, causing (Inhibiting) less auxin concentration promote growth in the root causing to curve or bend towards the soil (the ground). i.e more auxin in the lower side (shaded side) in hibite cellengation as compared to the shoot. But the effects of gravity in a horizontally placed seedling can be overcome by an instrument called klinostate (Clinostate).

☑ Klinostate is a rotating instrument. A seedling fixed horizontally in a rotating clinostate grow straight. Because the rotating distribute the auxin equally at all sides by overcoming the effects of gravity.

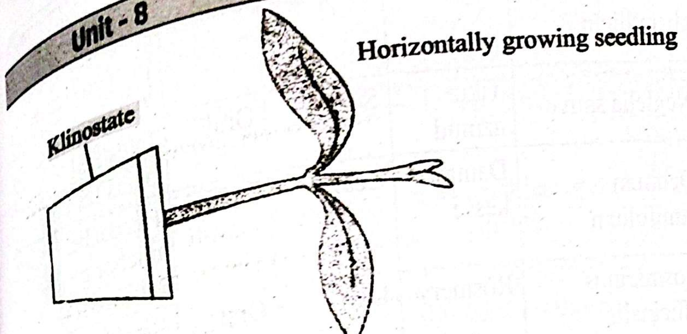

Horizontally growing seedling
Klinostate

Fig 8.23 Effects of klinostate on gravity (geotropism)

8.10 Medicinal Plants

Plants can produced organic products that have medicinal values, commercial and ornamental values. The plants that produce organic products that have medicinal values to protect diseases and fight infection.

☑ Globally, more that 60% of the world population including Ethiopia depends on traditionally (locally) available plant medicine for their health care.

Table 8 . 5 List of some Ethiopian Medicinal Plants and Diseases Treated.

	Scientific name	Local name	Plant part used	Route of Adminstrat	Disease Treated
1	Ruta chalepensis	Tena adam	Leaf	Oral	Abdominal pain
2	Zingiber officinalis	Jinjibl	Rhizome	Oral	Tonsilitis, cough, abdominal pain
3	Hagenia abyssinical	Kosso zaf	Seed (flower)	Oral	Tape worm treatment

4	Artemesia absinthium	Arithi	Leaf	Oral	Megagna (unex plained stomach ache)
5	Neglella sative	Tikur azmud	Seed	Oral	Intestinal parasites
6	Ocimum lamifolium	Dama kesse	Leaf	Nasal	Headache, michor general body illnes.
7	Rosmarinus officinalis	Rosmery	Leaf	Oral	Bronchial asthma prostate disorder inflammatory diseases
8	Cymbopogen ciratus	Tejsar	Leaf	Oral	Used for stomach complaint
9	Alium sativum	Nech shin kurt	bulb	Oral	Abdominal pain, tooth ache, tonsillitis; common clod
10	Eucalyptus gabulus	Nech - Bairzaf	Leaf	Nasal	Common cold, fever with headache
11	Curcurbita pepo	Dubba	Seed	Oral	Trap worm
12	Trigonella foenumgraecum	Abish	Seed	Oral	Mixed with garlic to treat asthma, used to treat gas tritis
13	Ocimum basilicum	Besobilla	leaf	Oral	Abdominal pain
14	Lepidum	Feto	Seed	Oral	Treatment of diarrhea.

Illustrative Example With Explanatory Not

117. Plant roots grow to wars the source of water in the soil. This is known as:

A. Chemotropism

B. Geotropism

C. Phototropism

D. Hydrotropism

Explanation

Hydrotropism is the growth response of the plants in response to water.

Answer: D

118. When a tendril comes in to contact with an object, it causes growth at the base of the tendril. This response is called;

A. Getropism

B. Thigmotropism

C. Hydrotropism

D. Chemotropism

Explanation

Thigmotropism is a growth in response to touch thus the above example shows the growth movement of tendril in response to touch of an object.

Answer: B

119. Which if the following is an example of hydrotropism?

A. Pollen tubes grow towards ovaries

B. Shoots grow towards light source

C. Roots grow towards a source of water

D. Tendrils grow around stems

Answer: C

Supplementary Exercises

Part VI Matching Items

Match the terms under column "B" With the description under column "A"

A	B
120. May be termed as starch sheath	A. Cone
121. Cells that leave an open space in leaf epidermis	B. Endodermis
122. Given mechanical strength to the stem	C. Flower
123. Single cells best suited for absorption	D. Guard
124. Is the site of origin of lateral roots F	E. Hypodermis
125. Reproductive structure of angiosperms C	F. Pericycle

126. Reproductive structure of gymnosperm

G. Root hair

H. Stomata

End of Unit Review Excercise

Part I. True/ False

Sat True for the correct statement and False for False - statement.

1. Cone is the reproductive structure of fruit - bearing plants.
2. CO2 is used in the stroma of the chloroplast.
3. A root hair is single cell.
4. Self pollination is possible in imperfect flower
5. Perfect flower contain all the four flowing structures (Stamen, pistile, pertal and sepal).

Part II Multiple Choice Items

Choose the correct answer from the given alternatives.

6. Which structure transport water to the leaf of a plant?
   A. Guard cell
   B. Phloem
   C. Stomata
   D. Xylem
7. Clinostate is used in the study of
   A. Osmosis
   B. Growth movement
   C. Leaf transpiration
   D. Photosynthesis
8. Which leaf - part contain the largest number of chloroplasts?
   A. Epidermis B. Palisade C. Cortex D. Spongy
9. One of the following is **not** the major characterstis of plants.
   A. Plants are composed of many eukarytic cells
   B. Plants are sessile (stationary) or do not show mobility.
   C. Plants are heterotrophic in their in their feeding habit
   D. Plants show both sexual and a sexual reproduction.
10. The two products of photosynthesis include
   A. CO_2 and O_2
   B. CO_2 and H_2O
   C. Carbohydrate & water
   D. Carbohydrate & O_2
11. Given the following:
   1.Pollination
   2. Seed - dispersal
   3. Pollen grains germination
   4. Flowering

   5. Seed germination

   The correct order of steps in the reproduction of a mature plant is:
   A. 1,3,2,4,5 B. 2,5,4,1,3 C. 4,2,5,1,3 D. 4,1,3,2,5
12. The removal of apical dominance is:
   A. Prunning B. Grafting C. Cutting D. Layering
13. The growth response of plants to gravity is detected by an apparatus called
   A. Klinostate
   B. GPS
   C. Photo light
   D. Tenderlis
14. Dominance of the growth of apical (tip) parts of the plant over the latteral branches of a plant is:-
   A. Kilnostate B. GPS C. Photo light D. Tenderlis
15. Which of the following is a typical example of an imperfect plant:
   A. Pea B. Coffee C. Papaya D. Corn (maize)

Shore Answer

16. How do you distinguish a root from an under ground stem?
17. What is the difference between an incomplete flower and an imperfect flower?
18. What is the difference between complete flower and perfect flower.
19. What is the difference between epigeal and hypogeal germination?
20. Explain a plant hormone especially known as auxin (IAA)?

Answer Keys

Supplementary Exercise

Part I Multiple choice Items

19. A
20. A
21. B
22. A
23. C
24. B
25. D
26. C
27. D
28. D

Part II. Matching Items

29. C
30. E
31. A
32. D
33. B

Part III. Multiple choice Items

41. B
42. C
43. B
44. B
45. A
46. B
47. B

48. A 49. D 50. D 51. B 52. A 53. C

Part IV Multiple choice items

66. D 68. C 70. B 72. A 74. B 76. D
67. A 69. A 71. C 73. A 75. B

Part V Multiple Choice Item

107. B 109. C 111. D 113. A 115. B
108. D 110. B 112. A 114. B 116. B

Part VI. Matching Items

120. B 122. E 124. F 126. A
121. D 123. G 125. C

Answer keys

For End of unit Review Exercises

Part I. True/ False Item

1. False 2. True 3. True 4. False 5. False

Part II Multiple Choice Items.

6. D 8. B 10.D 12.A 14.D
7. B 9. C 11.D 13.A 15.C

Answer for short answer item

16. Unlike under ground stem, roots does not have buds from where leaf and flower originated.

17. Incomplete flower can have stamen and pistile but may not have either sepal or petal. Imperfect flower have either stamen or pistile but not both. An imperfect flower is an incomplete flower but an incomplete flower can be perfect or imperfect.

18. Complete flower have all the four parts of a flower. Perfect flower have both stamen and pistile of a flower.

19. Epigeal germination The elongation of hypocotyl brings the cotyled above the ground. (Dicot seeds).

Hypogeal germination: The elongation of epicotyl leaving the cotyledon

below the ground. (Mono cot seeds)

20. Auxin (IAA) is a plant hormone that is involved in the follower activities:

- Stimulates elongation of new plant cells.
- Induces formation of roots on cuttings.
- Seed germination.
- Allows the plants to grow taller.
- Prevents falling of fruits before ripening.

UNIT 9

Biochemical Molecules

9.1 Biochemical Molecules

What is biochemical molecules?

Biochemical molecules are molecules that are found in living organisms. Living organisms are made up of biochemical molecules.

Classification of Biochemical molecules

Biochemical molecules can be classified in to two major categories. These are organic and in organic molecules.

Organic Molecules:- are biological molecules that contain carbon and hydrogen.

- They are the main structural components of living cells and tissues.
- The four major classes of organic molecules are carbohydrates, lipids, protein and nucleic acids.

In organic molecules:- are biological molecules that contain either carbon or hydrogen or neither of them. They are relatively small and simple compounds such as water, acids, bases and salts.

9.2 Inorganic Molecule : Water

Inorganic molecules are biochemical molecules that do not contain carbon and were not created through biological means except oxides of carbon and carbonate ions. Water is one of the most important inorganic molecules that play critical roles for the survival of living organisms.

Water is the most abundant inorganic molecules in living things. It covers around 75% of the body of living things. However, it varies based on the type and living style of organisms. Water is formed by a hydrogen bonding which is formed when two hydrogen atoms are bonded to one oxygen atom.

☑ Water is apolar substance. Thus, it has positive and negative charges on either end.

☑ **The hydrogen bond:** Besides the bonds joining the hydrogen atom to the oxygen atom there are very weak bonds and short lived called hydrogen bonds.

☑ The hydrogen bond join the oxygen in one water molecule to the hydrogen in another water molecule.

☑ The hydrogen bonds in water keep breaking and reforming as the molecule move around, but always bonding between the molecules in amass of water.

Characterstics and Importance of the Water

I. Some of the importance of water include:

1. It is habitat or a place to live for varieties of organisms.
2. It is transport medium
3. It is transparent. The transparency property of water allows light to pass deep in to water bodies in order to assist the photosynthetic process which is carried by aquatic plants and algaes.
4. It serves as a reactant in many chemical reactions for example, water serves as areactant in hydrolysis processes such as digestion.
5. Water is a vital chemical constituent of living cells.

II. Characterstics of water

i. Water has a high specific heat capacity

☑ This means that it takes quite a lot of energy to heat water up. water also loses heat quite slowly.

- ☑ Water stays more or less the same temperature. Especially in ocean and sea. (large masses of water).
- ☑ This is important for animals living in water as the enzymes are affected by temperature.
- ☑ The enzymes do not function efficiently in too hot or too cold.
- ☑ The heat capacity of water is high.
- ☑ The specific heat capacity of water is the amounts of heat energy necessary to raise the temperature of one kilogram of water by 1^{0}c.
- ☑ High heat capacity of water has crucial biological results since it make the water more resistant to temperature changes.

ii. Water has high latent heat of vaporization

- ☑ Latent heat of vaporization is the amounts of heat energy required to evaporate water.
- ☑ A lot of heat energy is lost from the body when heat returns liquid water (sweat) in to water vapour. As a result, it is a mechanism of regulation of body temperature by sweating in which evaporation of sweat significantly cools the body surface. This is called evaporative - cooling mechanisms.

iii. Water has high surface tension and cohesion

Surface tension is the tension at the surface of water (liquid) resulting from unbalanced forces (hydrogen bond) created on the molecules at the surface.

Thus, it is a measure of how difficult it is to break the surface of liquid.

- ☑ This property of water allow small organisms such as insects to walk on the water surface.
- ☑ Some others, like mosquito larvae, attach or hang themselves from the surface of the water and live just below the surface of water.
- ☑ The surface tension is sufficiently strong to hold their weight.

Cohesion: is the attractive forces between similar molecules (water molecules). This create a tension called cohesive force.

iv. Water is the universal solvent

Solvent is a substance which dissolves the solute in order to form a solution. Thus, since water is highly polar molecule, it dissolves all polar and ionic substances.

v. Water has the ideal viscosity for transport medium

- Viscosity is a measure of how fluid a liquid is flow easily.
- Thus, viscosity of water helps for effective transportation of substances in the body.

vi. Density and Freezing property

Water is a unique molecule in that its solid form, ice, is less dense than its liquid form.

- ☑ It is unusual for the solid form of a substance to floats on liquid water.
- ☑ This is because water expands when it freezes. when water expands it increase it's volume & decreases it's density.
- ☑ So, in cold weather, water freezes from the top down. The top freezes first.
- ☑ The ice on the surface acts as insulator and slows down the heat loss from the liquid water underneath.

vii. The boiling point of water is at 100^{0}c. the freezing point is at 0^{0}c.

Illustrative Example

1. Water has a high specific heat capacity. This means that it:

A. Heats up and cools down slowly
B. Heats up slowly and cools down quickly
C. Heats up quickly but cools down slowly
D. Heats up and cools down quickly

Answer: A

Explanation

Water has a high specific heat capacity means it heats up slowly and cools down slowly.

2. The high surface tension of water is due to:

A. Unbalanced hydrogen bonding in the body of water
B. Balance hydrogen bonding in the body of the water.
C. Balanced hydrogen bonding at the surface of the water.
D. Unbalanced hydrogen bonding at the surface of the water.

Explanation

Surface tension is the tension at the surface of liquid resulting from unbalanced hydrogen bonding (forces) at the surface of water

Answer: D

3. Organic molecules always contain:

A. Carbon
B. Carbon and oxygen
C. Carbon and hydrogen
D. Oxygen and hydrogen

Explanation

Organic molecules contain elements of carbon and hydrogen.

Answer: C

4. Which of the following groups of substances are all inorganic?

A. Water, sugar, calcium carbonate
B. Water, calcium carbonate, Co_2
C. Sugar, fatty acid
D. CO_2, amino acids & fatty acids

Explanation

Water, calcium carbonate & CO_2 are inorganic molecules.

Answer: B

Conceptual Example

5. Which property of water helps to regulate body temperature by sweating?

Explanation

Water has high latent heat of vaporization, which means high amounts of heat energy is required to evaporates water. A lot of heat energy is lost from the body, when heat vapourize sweat from the body.

6. What is the limiting factors for aquatic plants to carry out photosynthesis at far deepth of water?

Explanation

Water is transparent. This property of the water helps aquatic plants to carry out photosynthesis but light could not reach at far depth of water. Thus, sunlight is a limiting factor.

7. What is the benefit of ice being less dense than water?

Explanation

When water freezes it expands and increase its volume. When volume increases it's density decreases. Thus, the density of ice is less than the density of liquid water so ice (solid) float on liquid water. As aresults of this, water

- Water freezes from the top of water body to down ward.
- The liquid water is insulated under the ice
- The ice (solid) on the surface acts as insulator.
- Because of the warm water underneath the ice life (living things) in water continue in warm.

9.3 Inorganic Ions

Inorganic ions charged entities because they are atoms with unshared electrons in their outer shells. They are either positively or negatively charged.

☑ In organic ions found living bodies are referred to as minerals.

The occurrence, sources, and the roles of inorganic ions.

Classification of Inorganic ions

Based on their requirements in our daily diet, inorganic ions or minerals in the human body are divided in to two categories: These are macronutrients and micronutrients.

Table 9 . 1 Macro and Micro Nutrients Living System.

Macro nutrients	Micronutrients
☑ Sodium (Na)	☑ Iron (Fe)
☑ Phosphorus (P)	☑ Copper (Cu)
☑ Magnesium (Mg)	☑ Iodine (I_2)
☑ Potacium (K)	☑ Manganese (Mn), etc
☑ Sulfur (S)	
☑ Chloride	

Macronutrients:- required in more amounts in our daily life.

Micronutrients:- are called trace - elements. They required in very small amounts in our daily life.

i. **Hydrogen ions:-** They are found in the cytoplasm of cells as well as in the inter cellular fluid, blood, cerebrospinal fluid (CSF), and other body fluids.

The concenrtration of hydrogen ions is expressed in PH The scale range from zero or 1 to 14. The higher the PH, the lower the concentration of hydrogen ions, The PH and concentration of hydrogen ions have an inverse relation.

ii. **Sodium ions:** is the body's second most important positively charged ions.

- It is important in osmoregulation of the body.
- It also important for the proper functions of neuro - muscular system of the body.

iii. **Potasium ions:** is the positively charged ions present in the body. potasium ion is the major intracellular ions than sodium ions.

- In blood, potasium ions take electrolye that carries electric charge.
- Potasium is located inside the cells.
- Potasium is necessary for the normal functions of cells, nerve and muscles. It presents in fruis, banana, orange, vegetable like potatoe, & meat and liver.

iv. **Calcium ions:** calcium is the most abundant in organic ions present in our body.

- It is a positively charged ions required for the formation of bone and teeth.
- Calcium - rich food are milk and milk products. fish, egg yolk, beans and leafy vegetables.

v. **Phosphate ions:**

- It is anegatively charged inorganic ions (PO_4^{3-}). It combines with calcium to form bones and teeth.
- Food rich in phosphate ions are milk, cereals, meat and eggs.
- It is more abundantly present in cells.

vi. **Chloride ions:** A negatively charged inorganic ions present in extracellular fluids.

- It is taken along with sodium ions and perform its function together with sodium.
- It also used to mak HCl present in gastric juice.

vii. **Iron ions:** a positively charged ions.

- It is used to make haemoglobin of red blood cells called the red - iron protein.
- It is used to carry and transport oxygen in the circulation.
- It is an essential component of cytochromes that is components of the electron transport chain (ETC) in respiration. Iron - rich foods are legumes (bean) fish, red meat, liver, pumpkin seeds. etc.
- Iron is a components of peroxidase enzyme, alysosomalenzyme necessary for engulfing bacteria and other phagocytosed particle in white blood cells.

viii. **Iodine Ions:** Iodine is an inorganic ions (minerals) found in sea fish, iodized salt.

- It is important for thyroid gland health
- It is used in the synthesizing of iodine - containing hormone called thyroxin.

Supplementary Exercises

Part I Multiple choice Items

1. Which of the following is inorganic molecule/
   A. Glucose B. Starch C. Cellulose [✓ D. Water]
2. An element that is used for digestion of food is:
   A. Caicium B. iron C. Chlorine D. Phosphorous
3. The importance of hydrogen bond that exists between hydrogen and oxygen is:
   A. Makes up water molecule strong
   B. Makes up water molecule long lived
   C. Makes up water molecule weak
   D. Makes up water molecule rigid.
4. The transparency of water molecules is important for:
   A. The process of photosynthesis
   B. Increasing its surface solvent
   C. Making it a universal solvent
   D. All are posible answers.
5. The amount of heat required to raise the temperature of 1 kilofram of

water by 1^0 is:

A. High heat capacity

B. High latent heat of vaporization

C. High surface tension.

D. Cohesion.

6. The property of water that enable small organisms to walk on the water with out breaking its surface is:

A. Hear capacity C. Surface tension

B. Heat of vaporization D. Wone of the above.

7. The measure of how fluid flows easily is:

A. Cohesion B. Adhesion C. Viscosity D. Capillarity

Answer key

1. D 2. C 3. C 4. A 5. A 6. C 7. C

9.4 Organic Molecules

What is organic molecules?

Organic molecules are a compound that contains carbon and hydrogen found in living things.

➥ Carbon and hydrogen are the basis of organic life.

➥ There are four principal groups of organic compounds. These are carbohydrates, lipids, proteins and nucleic acids.

Table 9 . 2 Elements and monomers forming organic molecules.

Organic	Elements forming the molecule	Monomer
Proteins	C, H, O & N	Amino acids
Lipids	C, H & O	Fatty acids and Glycerols
Carbohydrates	C, H, & O	monosaccharides glucose fructose galactose
Nucleic acids	C, H, O, N & P	Nucleotides

Carbohydrates

What are carbohydrates?

☑ Carbohydrates are macro nutrients that the body needs in plenty amounts daily.

☑ It contains elements of C, H & O.

☑ It 's general formula is $(CH_2O)n$ ------ where $n > 3$.

☑ The ratio of hydrogen to oxygen atoms in carbohydrate molecules is always two to one (2 : 1)

☑ Carbohydrates are important sources of energy for body, cells. Generally all carbohydrates have the following properties:

➥ All have aldehydes or ketones functional group.

➥ All contains several OH (hydroxyl) groups.

➥ Their chemistry is determined by their OH - group.

☑ The simplest carbohydrate contain 12 atoms called triose monosaccharide. $(C_3H_6O_3)$.

☑ It ranges to very large molecules containing thousands of atoms.

Functions of Carbohydrates

☑ Carbohydrates have aranges of function:

i. They are important sources of energy for the body. Glucose is the most immediate energy source of the body.

ii. **Storage carbohydrate.**

➥ Carbohydrates are convenient form to store chemical energy.

Starch: plants store carbohydrates in the form of starch in their storage organs such as stem, leaves root, flower seeds.

Glycogen: Animals store carbohydrates in the form of glycogen.

➥ It is called animal starch.

Starch and glycogen are called polysaccharides.

iii. **Structural Carbohydrates**

➥ Some carbohydrates are used to build structures

➥ Thus, they are called structural carbohydrates

They are:

Cellulose: The primary cell wall of plants are made up of cellulose.

- Cellulose is apolysaccharide.

Chitin: Cell wall of fungi are made up of chitin.

- The exosketon of insects are also made up chitin.

Peptidoglycan: The cell wall of prokaryotes (bacteria) are made up peptidoglycan.

☑ Based on the number of sugar units they contain, carbohydrates can be classified in to three types. These are:

- Monosaccharides
- Disaccharides
- Polysaccharides

I. Monosaccharides

- Monosaccharides are simple sugar molecules that contain 3 to 6 atoms.
- They are the simplest and soluble forms of carbohydrates. They are dissolved quickly in water, forming sweet - tasting solution.
- They contain one sugar unit.

☑ Monosaccharides can be classified on the basis of the number of carbon atoms present in the molecule. They are:

- Trioses
- Pentoses
- Hexoses

i. Trioses: Contain three - carbon atoms.

- It is the simplest monosaccharides.
- It is an intermediate components of photosynthesis product.
- Example : Glyceraldehyde
  - Dehydroxyacetone.

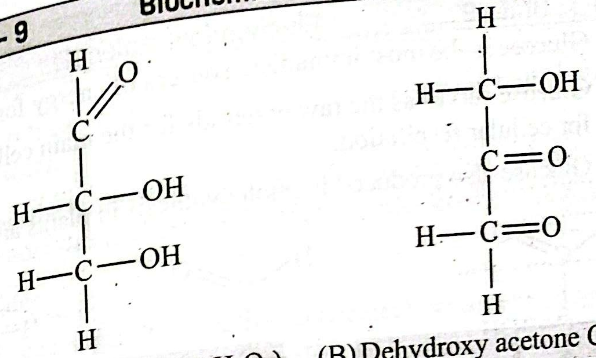


Fig 9.1 (A) Glyceraldehyde ($C_3H_6O_3$) (B) Dehydroxy acetone $C_3H_6O_3$

ii. Pentose: have 5 - carbon atoms.

- Formula $C_5H_{10}O_5$
- Which is a components of nucleic acids (RNA and DNA).

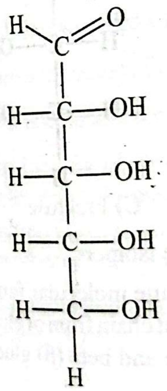


Fig 9.2 Ribose $C_5H_{10}O_5$

➲ The sugar in RNA

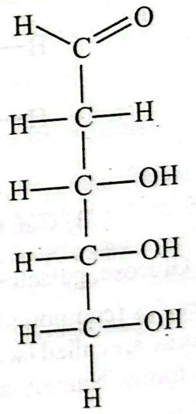


Fig 9.3 Deoxribose $C_5H_{10}O_4$

➲ The sugar in DNA

☑ The straight chain structure of monosacchardes appear in a ring form also when they are in solution.

iii. Hexose: carbohydrate which contain 6 - carbon atoms.

- Hexose sugar inculdes glucose, fructose and galactose. They are Isomers of each other.
- Molecular formula is $C_6H_{12}O_6$.

- Glucose is the most immadiate sources of energy for life.
- Glucose serves as the raw materials for the main cellular fuels used for cellular respiration.
- Glucose also produced in photosynthesis in plants and algaes.

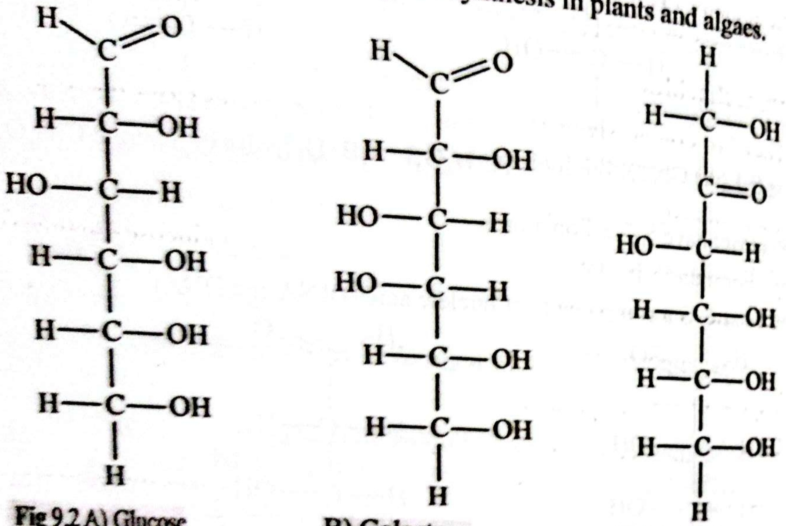


Fig 9.2 A) Glucose B) Galactose C) Fructose

They are isomers. Glucose, galactose & fructose are isomers.

Isomers: are molecules (compounds) having the same molecular formula but different structures. are called Isomers. The straight chain from of glucose produces two ring forms. Namely alpha (α) glucose and beta (β) glucose.

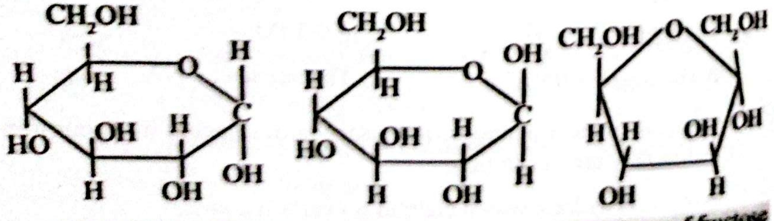


Fig 9.5 (A) Alpha(α) glucose

Beta(β) glucose (B)

Ring form of fructose (only one ring form) (C)

The difference between α - glucose and β - glucose is only on position of OH group (hydroxy group) on carbon number one.

The Role of monosaccharides in living organisms

☒ Monosaccharides are the simplest form of sugar and the most basic unit called monomers.

☒ Monomers are the basic constituent in which all carbohydrates are built. There fore, monosaccharides are the building blocks of carbonhydrates.

II. Disaccharides

☒ They are double sugar (two monosaccharides) units. The three most known disaccharides are:

☒ Maltose: maltose is a malt - sugar.

- It is composed of two glucose molecules. (glucose + glucose = maltose)

☒ **Sucrose:** Sucrose is called cane - sugar.

- It is composed of glucose + fructose = sucrose

☒ **Lactose:** Lactose is called milk - sugar.

- It is composed of glucose + galactose = lactose

☒ The formula of disaccharides is $C_{12}H_{22}O_{11}$. When one disaccharide molecule is formed one water molecule is lost. It is between the hydroxyl group from one monosaccharide and a hydrogen atom from the other molecule water is formed. This process is called condensation.

☒ **Condensation:** the process in which molecules combine to form a large molecules by producing water as a by - product is called condensation.

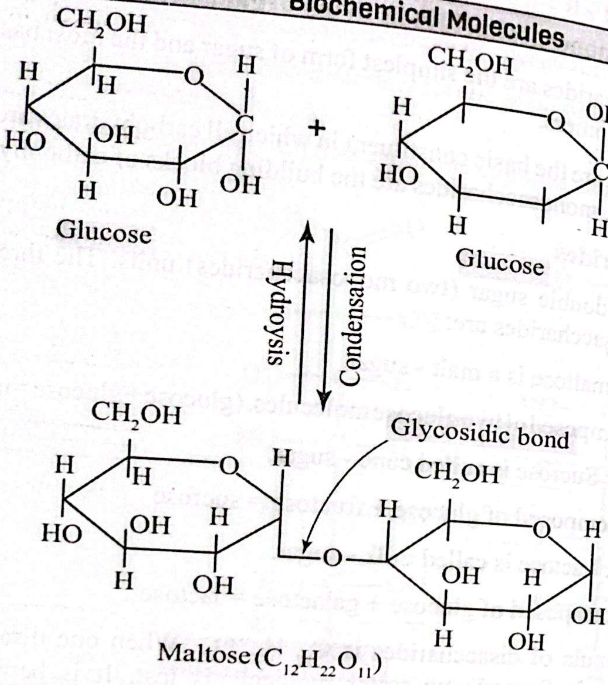


Fig 9.1 The molecules of glucose joined up to form maltose (disacchaeried)

III. Polysaccharide

- ☑ The most important polysaccharides are starch, glycogen and cellulose.
- ☑ Polysaccharides are made up of many monosaccharide units. They are polymers of glucose monomer units.
- ☑ The condensation reaction convert glucose to storage polysaccharides, which is convenient, compact, unreactive and insolube are starch in plants.
- ☑ The storage carbohydrates are starch in plants and glycogen in animals.
- ☑ Glucose can be available again guickly by hydrolysis.
- ☑ Hydrolysis is a process of splitting breaking down of the bond by the addition of water in to it's component is called hydrolysis.
- ☑ Hydrolysis is the opposite of condensation.
- ☑ Example glycogen can be hydrolys to split up in to many glucose molecules.

Starch: is apolysaccharide stored in plants in the form of starch in the storage organs such as stem, root, seeds, leaves.

Glycogen: is apolysaccharide in animals in which animals ingest starch, which is brocken down in to glucose. The glucose is absorbed by the cell and the surplus one stored in the form of glycogen in the liver.

Cellulose: is apolysaccharide that is naturally occurring biopolymer that is the most abundant. The cell wall of plant is made up of the cellulose, which provide structural support to the cell.

- Wood pulp, paper are example of cellulose.
- Cellulose is made up of glucose monomers that are linked together by carbon atom bond called glycosidic bind.

Conceptual Examples

8. Describe the chemical properties of carbon that make it central component of organic compounds.

Explanation

- Each carbon atom forms four covalent bonds with up to four other atoms, these bonds are single double or triple bonds.
- Carbon atoms form straight or branched chains or join in to rings.
- Carbon forms covalent bonds with greater number of different elements than does any type of atom.

9. Explain the relationship between polymers and macromolecules.

Explanation

- Long chains of monomers (similar organic compounds) linked together through condensation reaction are called polymers.
- Large polymers such as polysaccharides, proteins and DNA are referred to as macromolecules. They can be broken down by hydrolysis reacting.

10. Distingusn among monasaccharides, disaccharides and polysaccharides: compare storage polysaccharides with structural polysaccharides.

Explanation

- Carbohydrates contain elements carbon, hydrogen and oxygen in a ratio approximately one carbon to two hydrogen to one oxygen.

- Monosaccharides are simple sugars as glucose, fructose and ribose.
- Disaccharide - formed from two monosaccharides joined by glycosidie. They include substances such as sucrose, lactose and maltose.
- Polysaccharide - long chains of repeating units of a simple sugar. They include substances. Such as starch alycogen and cellulose.

11. Mention the characterstics of disaccharide?

Explanation

- Disacc harides are made up of two monosaccharide units. They are double sugar molecules.
- They are sweet taste.
- When two monosaccharides joined uby the condesation reaction disaccharides formed and water molecules are lost.
- They includes maltose, lactose & sucrose.

12. What is the difference similarities between glucose and fructose.

Explanation

- Glucose & fructose are hexose sugar.
- They have molecular formula of $C_6H_{12}O_6$.
- They are isomers ie the same molecular formula but different structure.
- The straight chain of glucose produces two rings forms. Namely α - glucose & β - glucose. But fructose has only one ring form.
- Glucose is an aldose sugar where as fructose is aketose sugar.

Illustrative Examples

8. Which of the following is the function of carbohydrate?

A. Substrate for respiration
B. Structural components of components of cells.
C. Store information
D. Store energy.

Explanation

Carbohydrates have wide range of importances among these some of the are:

- They are substrates for the process of respiration.

- They are convenient to store chemical energy.
  Example: Starch and glycogen.
- They are structural components of cell
  Example: Cellulose, cnitin.

Answer: C

9. Carbohydrates are classified based on.

A. The number of carbon they contain
B. The number of sugar unit
C. Their role
D. Their structure.

Explanation

Based on the number of sugar (saccharide) unit they contain, carbohydrates can be classified as:

- Monosaccharides (simple sugar).
- Disaccharides (double sugars).
- Poly saccharide (complex sugars).

∴ One sugar unit consists of 3 - 8 carbon atoms.

Answer: B

10. The sugars that are used to make nucleic acids are:

A. Glucose and fructose
B. Sucrose and ribose
C. Deoxyribose and glucose
D. Deoxyribose and ribose

Explanation

Among the nucleic acids:

- DNA consists of deoxyribose sugar
- RNA consists of ribose sugar.

Answer: D

11. Alpha (α) glucose differs form beta (β - glucose) in:

A. The - OH group is absent in the 1st carbon of α - glucose.
B. The - OH group on carbon number one of α - glucose is mirror image of β - glucose.
C. There is no difference in the arrangement of their OH - groups.

D. α - glucose has double bonds, while β - glucose does not posses double bonds.

Answer: B

12. The process by which disaccharides are produced is:

A. Condensation reaction between two monosaccharides.
B. Hydrolysis of monosaccharides.
C. Peptide bond between monosaccharides
D. All are possible

Explanation

Condensation reaction involves joining of two molecules to form larger molecule by producing water as a bi product. Thus, disaccarides are formed by the condensation reaction between two monosaccharides and lose water as a by - product.

$$C_6H_{12}O_6 + C_6H_{12}O_6 \rightarrow C_{12}H_{22}O_{11} + H_2O$$

Answer: A

13. The reaction in which two molecules combine to form a larger molecule and water is produced as a bi - product is:

A. Hydrogenation
C. Condensation
B. Hydrolysis
D. Dehydrogenation

Answer: C

14. Which of the following describes hydrolysis?

A. Taking up excess hydroxide ions.
B. Making a polymer by removing water.
C. Making water by combining on acid and base.
D. Adding water to break a polymer in to monomer units.

Explanation

The process of adding water to a polymer in order to break it in to its monomer units is called hydrolysis reaction.

Answer: D

15. Which of the following is important component of the exoskeleton of grasshopper?

A. Cuticle
B. Chitin
C. Protein
D. Oil

Explanation

Chitin which is a complex sugar is a structural component of exoskeleton of insects and cell wall of funfi.

Answer: B

16. How many carbon atoms are contained in a single molecule of sucrose?

A. 6
B. 12
C. 24
D. 48

Explanation

Sucrose has a molecular formula of $C_{12}H_{22}O_{11}$

Thus the number of carbon atoms contained in sucrose molecule are 12 carbon atoms.

Answer: B

17. Which of the following disaccharide sugar do babies get from the milk of their mothers?

A. Maltose
B. Sucrose
C. Lactose
D. Fructose

Explanation

Sugar	**Found in**
Maltose	Found in germinating seeds like barley
Sucrose	Found in sugar cane and table sugar
Lactose	Found in milk (Milk sugar).

18. Hexoses are:

A. Disaccharide molecule that contain six carbon atoms
B. Monosaccharides that contain six hydrogen atoms
C. Monosaccharides that contain six carbon atoms
D. Disaccharides that contain six oxygen atom.

Explanation

Hexoses are monosaccharides that contain six carbon atoms ($C_6H_{12}O_6$).

Answer: C

19. Which of the following is a polysaccharide?

A. Glucose
B. Glycosen
C. Maltose
D. Lactose

Explanation

Type of sugar	Example
Monosaccharide	Glucose, galactose, fructose
Disaccharide	Sucrose, maltose, lactose
Polysaccharide	Starch, chitin, cellulose, glycogen

Answer: B

20. Which of the following can produce more glucose by hydrolysis reaction.

A. Maltose B. Sucrose C. Disaccharide D. Starch

Explanation

Starch is complex sugar which consists of long chain of glucose units which are joined by glycosidic bonds. Thus it starch is hydrolyzed many glucose molecules are produced.

Answer: D

21. Which of the following pairs of elements are found in all carbohydrates in addition to the element carbon?

A. Nitrogen and oxygen C. Hydrogen and nitrogen
B. Hydrogen and oxygen D. Phosphorous and nitrogen

Explanation

All carbohydrates are composed of three types of elements. Namely carbon. hydrogen and oxygen.

Answer: B

22. All of the following carbohydrates are polysaccharide except:

A. Glucose B. Cellulose C. Starch D. Glycogen.

Explanation

Polysaccharides are complex sufars which are composed on a chain of sufars that are joined by glycosidic linkage some examples of poly saccharides are cellulose, starch, glycogen and polysaccecharides are cellulose, starch, glycogen and chitin.

Answer: A

23. Which of the following is compounds are both members of the pair are polymers of carbohydrates that naturally occur in plants?

A. Starch and chitin C. Clycogen and cellulose
B. Starch and cellulose D. Glycogen and chitin

Explanation

Starch and cellulose are commonly found in plants because:

- Starch is the storage form of carbohydrate in plants.
- Cellulose is the structural component of plant cell wall.

Answer: B

24. Which one of the following molecules in living things is not an organic molecule?

A. Sugar C. Amino acid
B. Nucleotide D. Water

Explanation

An except water are organic substances

Answer: D

Lipids

What are lipids?

Lipids are a varied group of compounds. like carbohydrates, lipids contain elements of C, H & O. But they contain much less oxygen than carbohydrates.

Lipids are oily or greasy consistency and are relative insoluble in water. They are soluble in non - polar organic solvents like benzene and alcohols. Lipids includes fats, oils and cholestrols. Fats and soil at room temperature. It is called animal fats Eg Butter meat oils are liquid at room temperature. It is called vegetable oil. Eg. copcconet oil, sunflower oil. olive oil, etc. Lipids are organic compounds formed by fatty acids and glycerol (alcohol). Lipids are avaried group of compounds that includes

- Triglycerides: formed from a glycerol that includes three fatty acids.
- Phospholipides: formed from glycerol, two fatty acids and aphospate group.
- Waxes: formed from fatty acids and long chain alcohols.

Major Functions of Triglycerides:

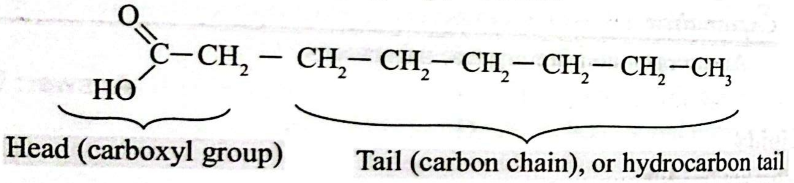
☑ Sources of energy: a molecules of triglycerides yields over twice as many molecules of ATP (twice as much energy) as a molecule of glucose.

☑ Thermal Insulation: the cells of adipose tissue (fats) found under the skin of many animals contain large a mounts of triglycerides, which give good thermal insulation.

☑ Buoyancy: lipids are less dense than water lipids (oil & fats) floats on water. Fat meat eater animals (carnivores) have less dense and can float on river.

☑ Water proofing: oils secreted on the surface of skin prevent water from entering are triglcerides.

The general formula of fatty acids is $CH_3(CH_2)nCOOH$ It contains the functional group called carboxyl group, - COOH.



Fatty acids consistes of head and hydrocarbon tail. The head consistes of the carboxy functional group and the hydrocarbon chains ($-CH_2-CH_2-$). The chain is often 15 or 17 carbon atoms long.

There are two types of fatty acids:

Saturated fatty acid, is a fatty acid that contain (- C - C -) single blond. It is solid at room temperature. It is called animal fats. Eg Butter, meat

The usaturated fatty acid Consistes of one or more (- C = C -) double bond. Here the number of hydrogen atom is less.

☑ The double bonds make fatty acids and lipids melt more easily. Most oil, vegetable oils are unsaturated fatty acids.

Example olive oil,palm - oil, etc.

☑ If more than one double bond between (- C = C -) it is called polyunsaturated fatty acid.

☑ If it is only one (- C = C -) double it is called monounsaturated.

Phospholipids

Phosplipids are one of the basic components of all cell membrane.

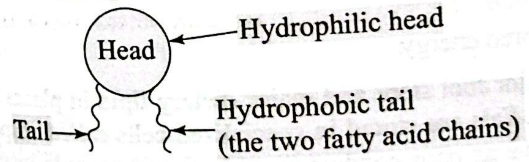
Phospholipids are formed when two fatty acids molecules are bonded to the glycerol and the place of the third is taken by a phosphate group.

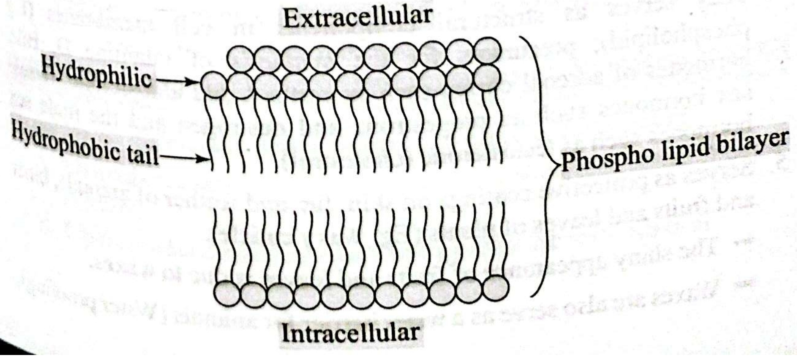
☑ The phosphate group is ionic and the hydrocarbon chains of the two fatty acids are covalently bonded.

☑ Two regions to a phopholipid molecule:

- **Hydrophilic region:** Water loving.
  - Consisting of the phosphate "head"
  - It is water soluble end.
  - It is polar and thus dissolved in water.
- **Hydro phobic region:**- water hating
  - It consistes of hydrocarbon chains of the fatty acid
  - Form membrane around the cell.
  - It is water insoluble region because it is non - polar.
- The two tails which are hydrophobic (Water hating) form a layer that is impermeable to hydrophilic substances.

Phospholipid





Phospholipid: formed from phosphate (PO_4^{3-}) glycerol and fatty acids

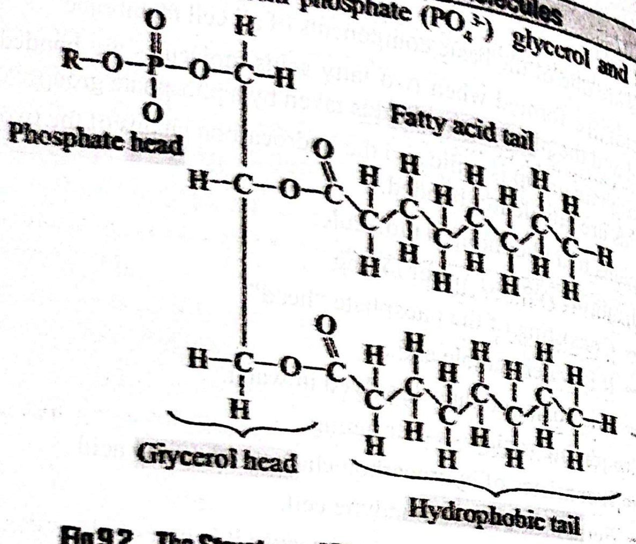


Fig 9.2 The Structure of Phospholipid Bilayer

Major Functions of Lipids

1. Fatty acids serves as the foundation for other types of other types of lipids.
2. It serves as stored energy.
3. Serves are major fuel store and major dietary lipid in plants (oil) and animals (fats). Fats are stored in specialized cells called adipose cells (fats cell), serve as poor conductors of heat and provide insulation at low temperature.
4. They serves as structural components in cell membranes (Eg phospholipid); precursors for the synthesis of vitamine D, Bile, hormones of adrenal cortex such as cortisol, and aldosterone; female sex hormones such as progestrone and oestrogen and the male sex hormones such as testosterone (cholestrol).
5. Serves as protective coatings on skin, fur, and feather of animals, birds and fruits and leaves of plants (Eg. Waxy cuticle).
   - The shiny appearance of fruits and leaves is due to waxes.
   - Waxes are also serve as a water barrier for animals (Water proofing),

---

birds and insects; and also thermal insulation (protects against cold).

Conceptual Examples

25. Why biological macromolecules are considered organic?

Explanation

It is because they contain carbon.

26. Describe the similarities and difference between glycogen and starch?

Explanation

Glycogen: is composed of only one molecule which is glucose.

- It is glucose polymers.
- It is animal starch (storage carbohydrate in animal)
- Glycogen has more branched structure than starch

Starch: is composed of two molecules, they are a my lose and amylopectin

- But both are glucose polymers.
- It is produced by plants and it is a storage carbohydrates in plants.
- Starch has both chains and branched but the branches are less than glycogen.

27. Explain at least three functions of lipids that serves in animals and/or plants.

Explanation

A. lipids serves as a storage of energy.
B. Serves as a structural components of hormones.
C. The basic structural components of cell membrane.
D. Serves as cell - signaling molecules.

Illustrative Examples

28. All are the differences between lipid and carbohydrate except:

A. All lipids are insoluble in water, while most carbohydrates dissolve in water.
B. Lipids produce twice as much energy than the same mass of

carbohydrate.

C. Lipids contain much oxygen that the same mass of carbohydrate.

D. None

Answer: D

29. A tissue responsible for storage of fat is:

A. Muscle B. Nerve C. Connective D. Adipose

Explanation

Fat is mainly stored in the inner layer of the skin called hypodermis which mainly consists of adipose tissues.

Answer: D

30. Hydrolysis of triglyceride yields:

A. One glycerol and three fatty acids

B. Two glycerol and two fatty acids

C. One fatty acid and three glycerols

D. One glycerol and two fatty acids

Explanation

Triglyceride is composed of a reaction between one glycerol and three fatty acids.

Answer: A

31. The functional group of fatty acid is:

A. Hydroxyl B. Carboxylic C. Sulphanylic D. NH_2

Explanation

The functional groups of fatty acids are COOH (carboxylic groups)

Answer: B

32. Which of the following is true about saturated fatty acids?

A. They have single bonds between carbon atoms.

B. They are the same as polyunsaturated fatty acid.

C. They are same as monounstaturated fatty acid.

D. They have double bonds between the carbon atoms.

Answer: A

33. Which of the following is produced when a lipid molecule is hydrolyzed?

A. Amino acid and water

B. Amino acid and glucose

C. Fatty acid and glycerol

D. Glucose and glycerol

Explanation

Hydrolysis of lipid molecule forms fatty acid glycerol molecules.

Answer: C

34. Which of the following is generally expected to give better health benefit when present in human diet?

A. Animal fat

B. Saturated fatty acid

C. Monounsaturated fatty acid

D. Poly unsaturated fatty acids

Answer: D

Explanation

Polyunsaturated fatty acids help to prevent cholesterol being laid down in the lining of arteries and prevent heart disease.

Answer: D

35. All are lipids except:

A. Cuticle of leavels

B. Steroid

C. Cholesterol

D. Chitin

Explanation

Chitin is a polysaccharide carbohydrate.

Answer: D

36. Compared to saturated fat unstaturated fat contains less?

A. Oxygen B. Fatty acid C. Glycerol D. Hydrogen

Explanation

Because of the presence of one or more double bond between C-atoms, the number of hydrogen present in unsaturated fat is less.

Answer: D

37. Oils are liquids at room temperature this is because.

A. They are made up of unsaturated hydrocarbon

B. They are made up of saturated hydrocarbon.

C. They are mainly composed of long chain of glycerol.

D. They have high proportion of oxygen.

Explanation

Oils are unsaturated fatty acids. Thus, unsaturated acids contain triglycerides that can easily separate at the double bond.

Answer: A

38. Which of the following statement is true about saturated fatty acids?

A. Saturated fat contain one or more double bond.
B. Saturated fat contain maximum number of hydrogen.
C. Saturated fat make up the majority of plant oil.
D. Food composed of saturated fat are good for our health.

Explanation

Saturated fatty acids:

- Contain maximum number of hydrogen.
- Contain single bonds between each carbon atom.
- They are mostly found in animal fat which is not good for our health.

Answer: B

39. The most abundant type of lipid in cell membrane is:

A. Phospholipid
B. Sterioid
C. Channel protein
D. Carrier protein

Explanation

Phospholipids are most a boundant types of lipids in the cell membrane because they exist in a bi - layer form in which the hydrophobic tails are sandwiched between the hydrophillic tails.

Answer: A

40. Which of the following lipids are stored below the dermis of homeotherms?

A. Lipids made up of unsaturated fatty acids.
B. Lipids that are made up of saturated fatty acid.
C. Lipids that are made up of cholesterol.
D. None.

Explanation

Saturated fatty acids are solids at room temperature. Thus, they have a tendency to be stored under the skin.

Answer: B

41. What makes phospholipid molecules arrange them selves in to a bi - layer in water medium?

A. The double bonds of the fatty acids.
B. The length of the fatty acid chains.
C. The presence of hydrophillic and hydrophobic groups.
D. Their high solubility in water

Answer: C

42. The property of triglyceride depends on:

A. Double or triple bond on the fatty acid.
B. The length of glycerol
C. The propety of glycerol
D. None of the above.

Explanation

The property of triglycerides is determined by

- The length of the chains
- The degree of saturation

Answer: A

Proteins

What are proteins?

Proteins are biological molecules composed of the elements carbon, hydrogen, oxygen and nitrogen. Many proteins also contain sulphur, and some also have phosporus.

- Proteins are very large molecules known as macromolecules.
- They are polymers, made up of many small units joined together. These small units are called amino acids. Amino acids are the monomers of proteins. They are combined in long chains to produce proteins.
- There are 20 amino acids in nature which are responsible for building thousands of different types of proteins. Amino acids different from one another by their R - group of side chains which are bonded to

CS CamScanner

the alpha - carbon.

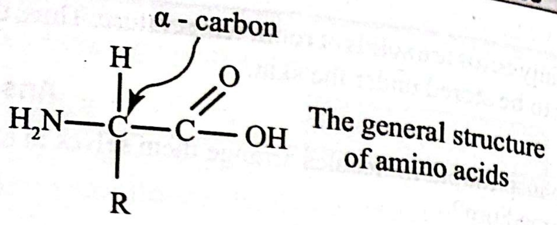


Fig 9.3 The general structure of amino acids

All amino acids have the basic structures of amino group (NH_2) and carboxyl (- COOH) group attached to the central carbon called α - carbon. α - carbon is the carbon atom to which the amino group, carboxy group, R - group and H - are joined.

One amino acids joined by another amino acid with a bond called peptide link, and when two amino acids joined adipeptide is formed. more and more amino acids can join together to form poly peptide chains (from around 10 to many thousands of amino acids long).

☑ Such chains of polypeptide is to form proteins.

☑ When one molecule of amino acid joined with the other amino acid molecule, water is released as a by-product. This reaction is called condensation reaction.

☑ About 18% of the human body is made up of proteins.

☑ This is a high proportion second to water.

☑ Proteins have the widest range of variety of functions than of any other - macromolecules.

Major Function of Proteins

i. **Structural Protein:-** are fibrous and tough, as well as insoluble in water.
  - They are structural elements of connective tissues, bones tendons, cartilages, nails, horns, hoofs and hair.
  - Collagen and keratins are structural proteins.

ii. **Enzymes:-** are globular proteins
  - All biological enzymes are proteins.
  - Proteins serves as a biological catalyst.
  - Enzymes catalyse metabolic reaction by lowering the activation energy, which increases the reaction rate.

Some examples of enzymes are DNA polymerase, nitrogenase, lipase, hydrolase, etc.

iii. **Hormones:-** hormones are proteins polypeptides that are long chains of linked amino acids.
  - They play critical roles in regulation of the body's physiological processes.
  - Hormone includes reproduction, growth and development, electrolytes, regulation etc.

iv. **Respiratory pigments:-** are globular protein pigments.
  - **Myoglobin:-** provide oxygen to the working muscles.
  - **Haemoglobin:-** transports oxygen to all tissues and organs via the blood.

v. **Transport proteins:-** are cell membrane structural components.
  - Proteins create channels in the plasma membrane to transport specific molecules with the cell.
  - Channel proteins and carrier proteins are examples of transport proteins.

vi. **Motor proteins:-** are involved in muscle contraction and relaxation.
  - Actin, myosin, kinesin and dynein are components of motor proteins.

vii. **Storage proteins:-** They serve as storage reserve for amino acids and metal ions.
  - They can be found in eggs, seeds, and pulses.

  Examples of storage proteins are ferritin, ovalbumin (albumin in egg), and caesin (Milk protein).

viii. **The immune system of the body:-** protection from diseases in the form of antibodies.

ix. **Structure of chromosomes**
  - The structure of a chromosome that wrap DNA is called histone, is a protein.

x. **Blood clotting by fibrinogen and prothrombin are proteins.**

Examplesofsomeaminoacidsarealanine,valine,lysine,Asparticacid,etc.

- **Amino acids attached to another amino acid by covalend bond. They differ one another in their R - groups. Proteins are classified in to two main groups, according to their molecular shapes: These are**

Globular proteins: have a tertiary structure that resembles a globule or ball - shaped. **Example** Enzymes and receptor proteins.

Fibrous proteins: have a tertiary structure that resembles along string, thread or fibre like

Example collagen and keratin (hair, nail, hooves, horn and claws are protein - keratins).

Conceptual Example

1. Explain the major functions of proteins

Explanation

Proteins are one of the widest range of functions of any macromolecules. The major functions of proteins are:

- Structural
- Regulatory
- Contractile
- Used in transportation
- Storage
- Plasma membrane
- Respiratory pigment
- Protective
- Biological enzymes

2. How many amino acids are found in nature? What is their responsibilities?

Explanation

There are 20 amino acids are in nature. These amino acids are responsible for building thousands of different types of proteins.

3. What is the function of α - carbon atom in amino acid structure? What is it's role?

Explanation

α - carbon atom is the carbon atom to which the amino group, carboxyl group, R - group and H - are joined. It is the central atom holding all groups in the structure of amino acids.

4. Explain the peptide link, dipeptide, and polypeptide.

Explanation

Amino acids are the building blocks of proteins they are joined together by the a bond called link (bond), and when two amino acids join, a dipeptide is the result. More and more amino acids can join together to form poly peptide chains.

5. What is the difference between polypeptide chains and proteins?

Explanation

From around ten to many thousands of amino acids long of poly peptide chains formed by joining up of amino acids. A polypeptide can fold or coil or become associated with other polypeptide chains to form a proteins.

6. What is condensation reaction? Explain

Explanation

When smaller molecules (Monomers) joined up to form larger molecules (polymers) and a molecules of water is lost called condensation reaction. Example formation of disaccharides, & polysaccharides from glucose (Monomer) molecules by the condensation reaction. Amino acids are also joined together by are action between the amino group of one amino acid and the carboxyl group of another amino acid. The Join in a condensation reaction and a molecule of water is lost. The bond formed is peptide bond.

7. Explain the difference between globular and fibrous protein

Explanation

Globular proteins are globule or ball she ped protein.

Example Enzymes, hormone, receptors, antibody are globule shape fibrous proteins are thread or fibre - like shape.

Example collagen and keratin. Collagen fibres are tendons, ligament and matrix. Keratin are hair, nail, hooves, horn and claws, are fibrous protein structure.

Illustrative Examples

43. Which of the following is NOT composed of protein?

A. Sex hormones B. Muscles

C. Hair D. Enzymes

Explanation

Muscles, hair and enzymes are composed of protein while, sex hormones are composed of steroides which are lipids

Answer: A

44. The element that is commonly found in protein but not in triglycerides is.

A. Oxygen B. Nitrogen C. Carbon D. Iron

Explanation

Triglycerides and proteins commonly contain elements carbon, hydrogen and oxygen. However, proteins differ from other organic compounds because they contain additional elements like nitrogen.

Answer: B

45. What is the role of protein in the body?

A. To transport oxygen
B. To defend the body from disease
C. To catalyze biological reactions
D. All

Explanation

Proteins have wide renge of importance for our body among these some of them are:

- To repair damaged tissues.
- To build body's muscles
- To make enzymes that catalyze biological reaction
- To maintain strength of the body and helping to fight disease
- To make hemoflobin, etc.

Answer: D

46. Which polymer is made up of diffrent classes of monomers?

A. Carbohydrates C. Fat
B. Protein D. Nucleotides

Explanation

Polymer	Monomer
Carbohydrates (complex sugar)	Sugar
Protein	Amino acid
Fat	Fatty acid and glycerol
DNA	Nucleotides

Answer: C

47. All proteins contain carbon, hydrogen, oxygen and what other element?

A. Chlorine B. Florine C. Nitrogen D. Sulphur

Explanation

All proteins contain four major elements These are carbon, hydrogen, oxygen and nitrogen in addition some groups of protein may contain sulphur and phosphorous.

Answer: C

48. One of the following molecules is building units of protein molecule.

A. Amino acide C. Nucleic acid
B. Glucose D. Fatty acid

Answer: A

Explanation

The building (monomer units) blocks of all protein molecules are amino acids.

49. Which of the following pairs of molecules are known to have catalytic activity?

A. Lipids are proteins C. Protein and RNA
B. Carbohydrates are protins D. Protein and DNA

Explanation

Catalyst is a substance that Effects the rate at which the chemical reaction takes place. Accordingly enzymes which are globular proteins and RNAs have catalytic activity.

Answer: C

50. Which of the following is NOT part of amino acid?

A. Hydrogen B. Carboxyl C. Hydroxyl D. Amino group

Explanation

Amino acid molecules are built around carbon atom which is attached to:

- Hydrogen atom
- Amino group (NH_2)
- Carbonlyl group (COON)
- R - group

Answer: C

51. Which of the following do not take part in peptide bond formation?

A. NH_2 B. R - group C. COOH D. Hydrogen

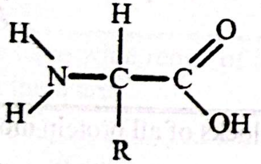
Answer: C

52. What are the functional groups of amino acids?

A. R - group B. COOH C. NH_2 D. B and C

Explanation

The general structure of amino acids can be shown as:



Answer: D

53. The primary structure of protein is firmly maintained by:

A. Hydrogen bind C. Peptide bond
B. Ionic bond D. Sulphahydral bond

Explanation

Primary structure of protein is formed when many amino acid are joined by peptide bond to form a polypeptide chain.

Answer: C

54. Which of the following element is found in protein and nucleic acids

but not in carbohydrates.

A. Carbon B. Nitrogen C. Oxygen D. Hydrogen

Explanation

Carbohydrates contain elements carbon hydrogen and oxygen. Nucleic acids and protein contain elements carbon hydrogen, oxygen and nitrogen in common.

Answer: B

55. Which of the following is adistinfuishing feature of amino acids that is NOT found in carbohydrates?

A. Carbon B. Oxygen C. Hydrogen D. Nitrogen

Explanation

Answer: D

See example number 88

56. Which of the following is true about the substance represented by the chemical formula “$C_2 H_5$ No”?

A. Simple sugar C. Fatty acids
B. Inorganic substance D. Amino acids.

Explanation

The substance indicated is most probably be amino acid. This is because it contain elements carbon, hydrogen, oxygen and nitrogen.

Answer: D

Nucleic Acids

What is nucleic acid?

Nucleic acid is along chain of nucleotide units.

☒ Nucleic acid consistes of DNA (Deoxyribonucleic acid) and RNA (Ribonucleic acid).

☒ Nucleotides are the building blocks of nucleic acids.

☒ **Nucleotide** is a monomer that link together to form a polymer called nucleic acids (DNA and RNA).

☒ Nucleotides consistes of three parts:

These are:- a sugar

- a Base
- a phosphate group

The Nucleotides in DNA

The nucleotides in DNA consistes of:

1. Deoxyribose sugar, pentose sugar ($C_5H_{10}O_4$), a 5C - sugar.
2. Phosphate group
3. Nitrogen bases (Bases)

These bases are:- Adenine (A)
- Guanine (G)
- Cytosine (C)
- Thyamine (T)

☑ DNA is an organic compound of complex structure that is found in all prokaryotic and eukaryotic cells.

☑ DNA is a key to life because it determines how a cell replicates and performs its varies activities.

☑ DNA is found in the nucleus.

☑ DNA is a huge molecule made up of two strands of nucleotides wound in to a double helix (double strands).

☑ DNA is a genetic materials

☑ DNA is parts of a chromosomes.

☑ Genes are a short segment (short - section) of DNA.

☑ Genes code for a specific protein and determines a particular features.

☑ DNA replicate itself by the process of replication.

☑ The nitrogen base which are double ringed are called purines. These are adenine and guanine.

☑ The nitrogen bases which are one ringed are called pyramidines. These are cytosine, thymine (T - in DNA) & uracil (uracil in RNA).

In a double stranded DNA molecule, the base on one strand is complementary to the base on the other strand.

A=T or T= A
G=C or C =G

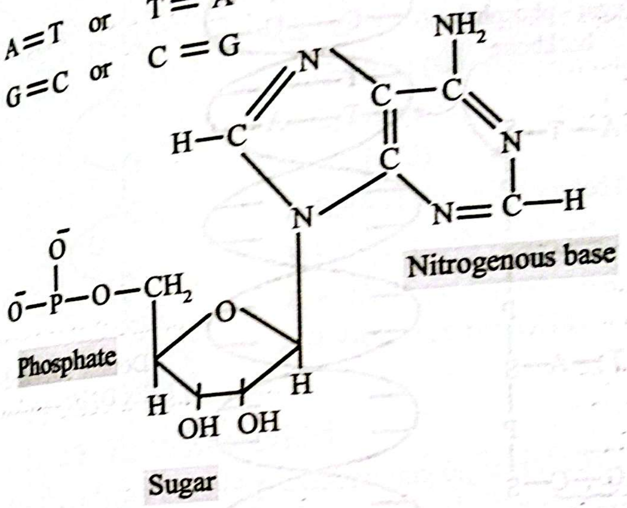


Fig 9.4 The Structure of DNA Nucleotide

Note: DNA strand DNA Molecule
- Each DNA Molecule is made from two DNA strands.
- One DNA molecule is made up of two DNA strand.

The structure of nucleotide

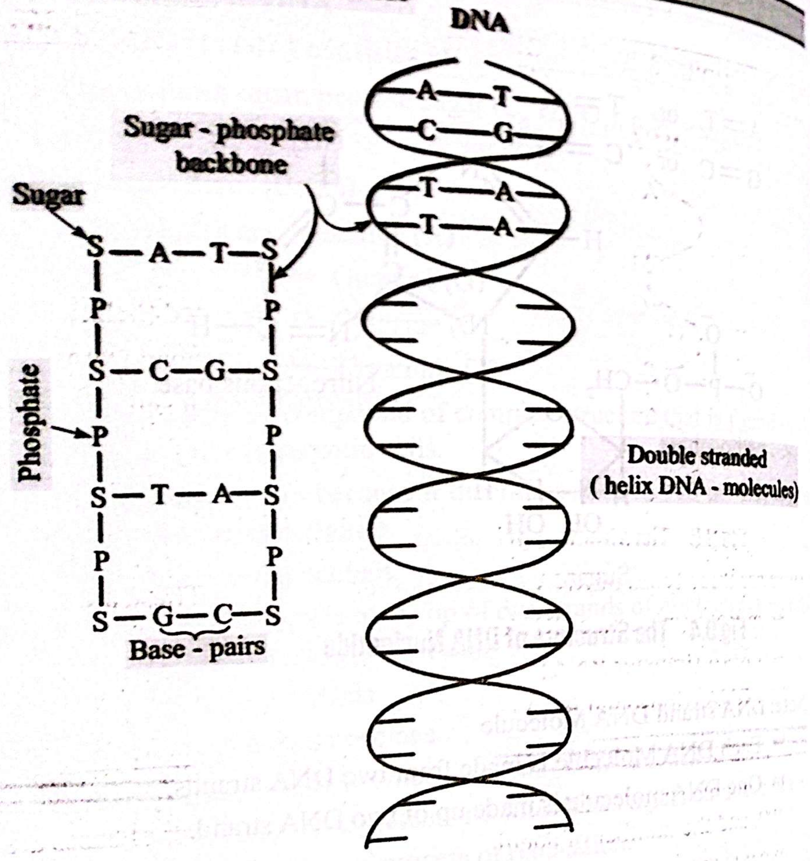

DNA
Sugar - phosphate backbone
Sugar
Phosphate
S—A—T—S
P P
S—C—G—S
P P
S—T—A—S
P P
S—G—C—S
Base - pairs
A—T
C—G
T—A
T—A
Double stranded
(helix DNA - molecules)

Fig 9.5 DNA - structure

The Nucleotides in RNA

RNA is a nucleic acid found both in the nucleus and the cytopasm.

The nucleiotides in RNA consistes of:

1. Ribose, sugar, (Pentose sugar ($C_5 H_{10} O_5$), a5C - sugar
2. Phosphate group
3. Nitrogen bases (bases):

These are:- Adenine (A)

- ➢ Guanine (G)
- ➢ Cytosine (C)
- ➢ Uracil (U)
- ➢ RNA is single - stranded (helix)
- ➢ RNA is much smaller than DNA
- ➢ RNA do not replicate it self
- ➢ RNA is made on DNA.

RNA
A
G
C
U
A
C
G

Fig 9.6 The structure of RNA

There are three types of RNA present among organisms: These are

- m RNA (messanger RNA)
- t RNA (transfer RNA)
- r RNA (ribosomal RNA)

Conceptual Example

1. In a double stranded DNA molecules, If the total number of bases are 300, and the number of adenine is 80.
What is the number of tyamine, cytosine and guanine bases.

Explanation

Adenine (A) base is always complementary to tyamine (T) base. If A = 80 Thyamine also 80. A + T = 80 + 80 = 160 bases. The total number of base are 300. 300 - 160 = 140 Guanine is always complementary and equal to cytosine is always complementary and equal to cytosine. The remaining 140 bases are divided in to two equal amounts of guanine & cytosine There fore, Guane = 70 and cytosine = 70.

2. Compare DNA and RNA

Explanation

DNA	RNA
☑ Double stranded	☑ Single stranded.
☑ Always found in the nucleus	☑ Found both in the nucleus and in the cytoplasm.
☑ Very large molecule	☑ Smaller than DNA
☑ Can replicate itself	☑ Do not replicate itself RNA itself made on DNA
☑ Deoxyribose sugar	☑ Ribose sugar.
☑ Contain base of A,G,C & T	☑ Containbasesof A,G,Canduracile(U).

3. Mention the nucleotides in DNA molecules.

Explanation

Nucleotides are the building blocks of DNA molecule. It consistes of

1. Deoxyribose sugar
2. Phosphate group
3. Nitrogen bases (A, G, C & T)

Illustrative Examples

57. RNA is composed of:

A. A single polyncleotide chain
B. Two polypeptide chains
C. Protein
D. A and B

Explanation

RAN Cribonucleic acid is a nucleic acid that is composed of a single polynucleotide chain Thus, it is single stranded .

Answer: A

58. Which of the following is true about all nucleic acids?

A. They are polymers of nucleotide
B. They are polymers of amino acid
C. They are doubled strand
D. All are correct except B

Explanation

All nucleic acids (RNA and DNA) are the polymers which are composed of chain of monomer units called nucleotides

Answer: A

59. All are the characterstics of DNA, except:

A. They are stable
B. They carry code for many proteins
C. They degenerate after the formation of proteins
D. They are double stranded

Explanation

DNA Molecules are

- Stable molecules
- Carry codes for many proteins
- Double stranded
- Capable of duplication (copying) themselves.

Answer: C

60. The number of thymine bases in a DNA molecule equals with:

A. Guanine
B. Adenine
C. Cytosine
D. Uracil

Answer: B

Explanation

In a DNA molecule the number of thymine base is always equal to the number of adenine base and the number of guanine equals with cytosine base.

61. What are the three components of DNA molecules?

A. Glucose, nitrogen and phosphate
B. Sugar, phosphate group and nitrogenous base
C. Protein, carbohydrate, fat
D. Monosaccharide, disaccharide and polysaccharide

Explanation

The nucleotides which are the building bloks of DNA molecule are composed of:

- Pentose sugar (deoxyribose)
- Phospate group

➥ Nitrogenuse bases (Adenine, thymin, guanine, cytosine)

Answer: B

62. The nitrogenous base that is absent in the nucleotides of DNA molecule is:

A. Adenine B. Uracil C. Thymine D. Guanine

Explanation

DNA molecule consists of nitrogenous bases adenine, thymine, guanine and cytosine but not uracil.

Answer: B

63. What is the bond that exists between nucleotides?

A. Phosphdiaster bond C. Peptide bond
B. Gster bond D. Glycosidic bond

Explanation

Phosphodiaster bond is used to join nucleotide together to make a polynucleotide chain.

Answer: A

64. The bond that exist between the complementary nitrogenous bases is:

A. Ionic bond C. Coordinate bond
B. Peptide bond D. Hydrogen bond

Explanation

Hydrogen bond is important in linking the nitrogenous bases between the complementary nitrogenous bases.

Answer: D

65. Which one of the following statement is true about DNA and RNA?

A. Both are single stranded
B. Both have a five carbon sugar
C. Both are polymers of amino acids
D. Both contain the same four nitrogenous bases.

Explanation

Both DNA and RNA contain five carbon sugars which are called deoxyribose sugar and ribose sugar respectively.

Answer: B.

66. It is known that the total percentage proportion of purine bases in a DNA molecule is 50% and all the four bases in a DNA molecule proportion of thymine base?

A. 25% B. 50% C. 75% D. 100%

Explanation

Purines (Adenine and guanine) = 50% of the bases pyrimidines (cytosine and thymine) = 50% of the base. There form since all the four bases have equal proportions as mentioned in the question, the percentage proportion of tymine is 25% How every. the number of all bases is not always expected to be proportional.

Answer: A

67. Which of the following organic substance are correctly matched with their building blocks?

A. Carbohydrate - glycerol C. Lipids - amino acids
B. Proteins - fatty acids D. Nucleic acids - nucleotide

Explanation

Organic substance	Building block
Carbohydrate	Simple sugars
Proteins	Amino acids
Lipids	Fatty acid and glycerol
Nucleic acids	Nucleotides

Answer: D

68. In which of their consituents do the nucleotides of DNA and RNA differ?

A. In their purine base C. In the phosphate group
B. In the pyrimidine base D. All of the above

Explanation

The nucleotide of DNA and RNA differ on the pyramidine base in which DNA has thymine base while, RNA has uracil base instead.

End of unit Review Exercises

Part I Mach the most appropriate from the column B for each entry in column A

A	B
69. Mono saccharide	a) Cellulose
70. Nucleic acid	b) DNA
71. Important constitut of cell membrane	c) Glucose
72. Subunits of proteins	d) Cholesterol
73. Energy currency of cell	e) ATP
74. Compounds with same molecular formula but different structures	f) Glycerol
75. Component of fatty acids	g) Hydrocarbons
76. Organic carbon consisting only of carbon hydrogen,oxygen, nitrogen.	h) Amino acids
	i) Phospholipids
	j) Isomers
	k) Amino acids

Part II Fill in the blank spaces with approprate Answer

77. Peptide bonds are found linking ______ .

78. When sucrose is hydrolyzed _____ and _____ are formed.

79. ______ is an important component of the cell wall of plant cells.

80. The fatty acid portion of the phospholipid is _____ and will not dissolve in water.

81. The three functional groups which make up the amino acid are the _____ , ________ and the R group.

82. Animals store glucose in the form of ______ .

83. Part IV Choose property of water?

A. The water molecule is non - polar

B. Solid water is denser than liquid water

C. Water molecules repel other water molecules.

D. None.

84. Who first proposed the double - helix structure of the DNA molecule?

A. Pauling

B. Mc clintock

C. Waston and crick

D. Harris and watkins

85. Which is common to both DNA and RNA?

A. Uracli

B. Thymine

C. Cytosine

D. Deoxyribose

86. Which statement best describes the relationship between proteins and polypeptides?

A. Proteins are composed of polypeptide

B. Polypeptides are composed of proteins.

C. Proteins, unlike polypeptiedes are composed of amino acids.

D. Polypeptides, unlike proteins, are composed of amino acids.

87. What are the sub units of DNA and their function?

A. Nucleotide that store information.

B. Monosaccharides that provide quick energy for the cell.

C. Lipids that store energy and provide insulation.

D. Proteins that provide the building blocks for the structural components of organisms.

88. Water is used as a areactant in:

A. Photosynthesis

B. Hydrolysis reaction

C. Respiration

D. A and B are possible

89. Organic molecules that contains nitrogen are:

A. Lipids

B. Proteins

C. Carbohydrates

D. All are possible

90. Which of the following is double sugar?

A. Starch

B. Glycogen

C. Lactose

D. Fructose

91. Which of the following in groups of carbohydrate to triose?

A. Glyceraldehyde

B. Ribose

C. Deoxyribose

D. Glucose

92. The sugars that make nucleic acids are

A. Glyceral dehyde and dihyderoxy acetone

B. Ribose and deoxyribose

C. Glucose and fructose

D. Starch and glycogen

93. Gluose differs from galactose in

A. The position of - OH group on the fourth carbon
B. The carboxyl group on the first carbon.
C. The presence of hydroxyl group
D. All are possible

94. The functional group - NH_2 is a (n)

A. Carboxyl group C. hydroxyl group E. Carbonyl group
B. amino group D. Phosphate group

95. Triglyceride contains fatty acids and

A. Glucose B. Glycogen C. Glycerol D. Amino group

96. In a DNA molecule, what holds together nitrogenous bases from the two polymer chain?

A. Phosphodiester bonds C. Peptide bond
B. Ionic bonds D. Hydrogen bond

97. What types of macromolecule carries out catalysis in biological systems?

A. Proteins called enzymes
B. Carbohydrates called starches
C. Lipids called steroids
D. Nucleic acid called DNA

98. A hydrocarbon is said tobe saturated it

A. One end of the molecule is hydrophilis while the other end is hydrophobic
B. It has one or more double bonds between carbon atoms.
C. Each internal carbon atom is covalently bonded to two hydrogen atoms.
D. Its functional group include at least one aromatic ring.

99. The two strands of a DNA double helix are held together by

A. Ionic bond D. Polar covalent bond
B. Hydrogen bond E. Hydrophobic exclusions
C. Non polar convalent bond

100. Which of the following differs in its molecular formula?

A. Glucose B. Galactose C. Sucrose D. Fructose

101. Which of the following is true about saturated fatty acids?

A. Contain maximum possible number of hydrogen atom
B. Some of the carbon - carbon bonds are multiples bonds.
C. Tend to be liquids at room temperature
D. All except "C"

102. A disaccharde that is formed between two α - glucose molecules is:

A. Maltose B. Sucrose C. Lactose D. Glucose

103. The reaction in which two molecules are joined to form a large molecule, that produces water as a by product is:

A. Hydrolysis B. Condensation C. Saturation D. None

104. ___ is the process of splitting disaccarides in to monosacccharide:

A. Hydrolysis C. Saturation
B. Condensation D. Unsaturation

105. Which of the following is not a polymer?

A. Protein C. Amino acid
B. Starch D. Glycogen

106. Which of the following polysaccharide is correctly

A. Cellulose - component of cell membrane
B. Starch - storage form of fats in plants
C. Glycogen - storage form of carbohydrate in animals.
D. Chitin - structural components of plant cell wall.

107. The bond between amino acids are:

A. Hydrogen bond C. glycosidic bond
B. Peptide bond D. Ester bond

108. Which of the following is Not a components of DNA?

A. Dexyribose sugar C. Phosphate group
B. Ribose sugar D. Nitrogen bases

109. What make RNA different from DNA?

A. It is relatively large
B. It is double stranded
C. It contains uracile instead of tyamine
D. All are possible

Part V True/ False items

Say True if the statement is correct and False of the statement is incorrect.

110. Deficiency disease caused by lack of iron in our food is called goiter.
111. DNA is termed as a genetic material
112. All proteins are made up of fatty acids an glycerol molecules.
113. Phospholipids are molecules that are used for adipeptide bond formation.
114. Maltose is adisaccheride made of two glucose units.
115. DNA is made of 5 - carbon ribose, phosphate.
116. Calcium is one of the inorganic ions that are used for bone and teeth formation.
117. Water is a universal solvent.
118. Proteins are made up of bet glucose molecules.
119. Glycogen is a storage form of polysaccharide in animals.

Part VI multiple choice items

Choose the correct answer from the given alternatives

120. Disaccharide consistes of:
    A. Two molecules of monosaccharides
    B. Three molecules of monosaccharides
    C. Four molecules of monosaccharides
    D. Five molecules of Monosaccharides

121. The basic unit of protein molecule is ____
    A. Peptide B. Amino acids C. albumin D. glycine

122. Which of the following is not a macromolecule?
    A. RNA B. DNA C. Salt D. Protein

123. The bonds that form between the atoms of poly neric macromolecules are ______ bonds.
    A. Hydrogen B. Peptide C. Disulfide D. Covalent

124. Which of the following does not represent a correct monomer/polymer pairing?

A. Monosaccharide /polysaccharide
B. Amino acid /protein
C. Triglyceride /cellulose
D. Nucleotide /Nucleic acid

125. Polymerization reactions in which polysaccharides are synthesized from monosaccharides.
    A. Requires the formation of phosphodiester bonds between the amino acids.
    B. Are hydrolysis reactions
    C. Depends up on van der waals forces to hold the amino acids together.
    D. Results in the formation of water.

126. During the formation of a peptide linkage, a ____ is formed.
    A. Molecule of water C. Hydrophobic bond
    B. Disulfide bridge D. Hydrophilic bond

127. Which of the following is responsible for making every amino acids unique?
    A. Amino group C. Carboxyl group
    B. Hydrogen D. "R" group

128. Enzymes are:
    A. DNA B. Lipids C. Carbohydrat D. Proteins

129. A protein molecule is made of ____
    A. amino acids
    B. glycerol & fatty acid monomers
    C. glucose monomers D. Only fatty acids

130. The monomers that make up polymeric carbohydrate like starch are called.
    A. Nucleotides C. Monosaccharids
    B. Trisaccharides D. Nucleo side acid

131. A simple sugar with the formula $C_5 H_{10} O_5$ can be classified as a ____
    A. hexose C. Disacclaride
    B. Polysaccharides D. Pentose

132. DNA and RNA both include:
    A. Pentoses B. hexoses C. fructoses D. Maltoses

133. Lactose is classified as:
A. disaccharide
B. hexose
C. Pentose
D. Pilysaccharide

134. Which of the following is not the function of calcium:
A. Formation of bone and teeth
B. Formation of ligament
C. Developments of muscle
D. All are not it's function

135. Which property of water allow some insects to walk the surface of water?
A. Surface tension
B. High specific heat
C. Liquidity
D. Changing state

Answer Keys

End of unit Review Exercises

Part I Matching items

69. C
70. B
71. I
72. H
73. E
74. J
75.F
76. K

Part II Fill in the blanks spaces

77. Amino acid molecules
78. Glucose and fructose
79. Cellulose
80. Hydrophobic portion
81. Amino group (NH_2) and carboxylic group (COOH)
82. Glycogen

Answer Keys

For End of unit Review exercises

Part IV multiple choice Items

83. D
84. C
85. C
86. A
87. A
88. A
89. B
90. C
91. A
92. B
93. A
94. B
95. C
96. D
97. A
98. B
99. B
100. C
101. A
102. A
103. B
104. A
105. C
106. C
107. B
108. B
109. C

Part V True/ False Items

110. False
111. True
112. False
113. False
114. True
115. False
116. True
117. True
118. False
119. True

Part VI. Multiple choice items

120. A
121. B
122. C
123. D
124. C
125. D
126. A
127. D
128. D
129. A
130. C
131. D
132. A
133. A
134. C
135. A

UNIT 10

Cell Cycle

10.1 What is a Cell Cycle?

Cell cycle is the life cycle of a cell.

The cell cycle is a repeating sequence of Cellular growth and division during the life of a cell.

Which means a sequence of events that takes place in the parent cell as a means of distributing genetic materials there by forming daughters cells is called **cell cycle**. The life of a eukaryotic cell cycles through phases of growth, DNA replication, preparation for cell division and division of the nucleus and cytoplasm. The cell cycle is made up of five phases, the first three phases together are known as inter phase. The remaining two phases are called cell division. There fore, we can say that the two main division of the cell cycle are inter phase and cell division.

i. **Inter phase:** Inter phase is divided in to three phases They are:

- ➥ G_1 (Cell growth) phase
- ➥ S (DNA Synthesis) phase
- ➥ G_2 (Growth and preparation for mitosis) phase

☑ A cell will be in inter phase for much of its life this used to be called the resting phase.

☑ Cell spends most of its time in the inter phase, because it performs multiple activities, including growing and preparing itself for division by:

- Assembling the building blocks of chromosomal DNA and the associated proteins
- Completing the task of replicating each chromosome in the nucleus.
- Synthesizing proteins necessary for chromosome manipulation and movement.
- Duplicating some cell organelles.

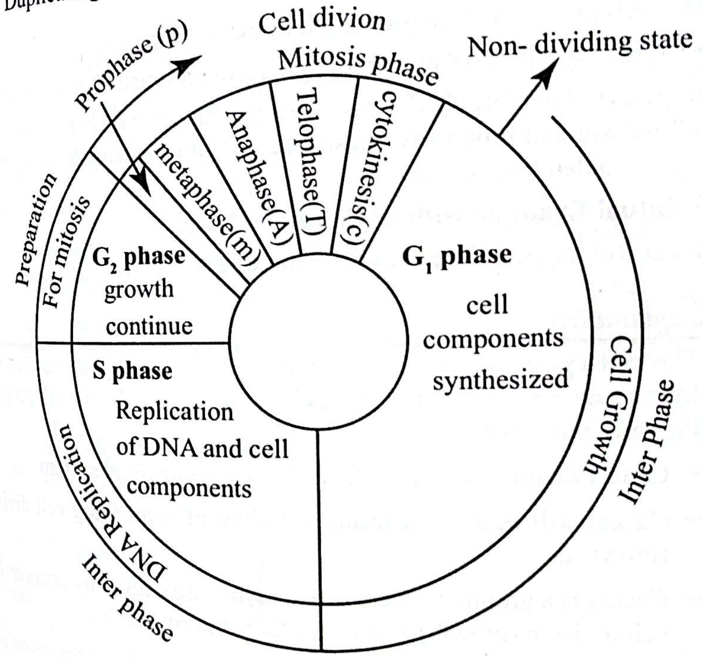

Cell divion
Mitosis phase
Non- dividing state
Prophase (p)
metaphase(m)
Anaphase(A)
Telophase(T)
cytokinesis(c)
Preparation
For mitosis
G_2 phase
growth
continue
G_1 phase
cell
components
synthesized
S phase
Replication
of DNA and cell
components
DNA Replication
Inter phase
Cell Growth
Inter Phase

Fig 10.1 The Cell Cycle

G_1 Phase (First Gap Phase): The first stage of inter phase

- ➥ A cell grows rapidly (actively) as the cell builds more organelles.
- ➥ This phase occupies the major portion of the cell's life.
- ➥ Cells that are not dividing remains in the G_1 phase.

S phase (Synthesis of DNA)

- It is the stage DNA replication (synthesis)
- Each chromosomes now consistes of two identical chromatides that are attached at the centromere.

G_2 Phase (the second gap phase):

- The cell continues to grow and prepares to divide.
- The cell forms some special structures that help the cell divide.
- The hollow protein fibres called micro tubules are organized for division.
- Cells many continue growing during the G_2 phase.
- Cells make the final preparations before entering to thee mitotic phase.

Inter phase: The period of the cell cycle during which activities such as cell growth and protein synthesis occurs with out visible sings of cell division is called Inter phase.

Conceptual Example with explanatory Note.

☑ What will happen if a cell cycle is not controlled?

Explanation

The cell cycle has an internal controlling system that enables it to follow regular pattern. If such regulatory system fails to work properly, the cells excessively divide.

- Cancer do not respond to the cell cycle controlling system.
- Cancer will occur as a result of failure of controlling cell division (growth).
- Cancer is a group of severe diseases that are caused by uncontrolled cell division (growth) and spread of subnormal cells.
- Uncontrolled cell growth and division can result in masses of cells that invade and destroy healthy tissues.
- The best way to prevent cancer is to avoid things that can cancer ultraviolet radiation (UV - radiation) in sun light, chemical in cigarette smoke, etc can damage genes that control the cell cycle.

10.2 The Cell Division

What is cell division?

☑ Cell division is a means to increase cell number.

☑ These cells are amaens of repairing for tissue renewal as well as for growth.

☑ Cell division is a means of growth and replacing damaged or dead cells in multicellular organisms.

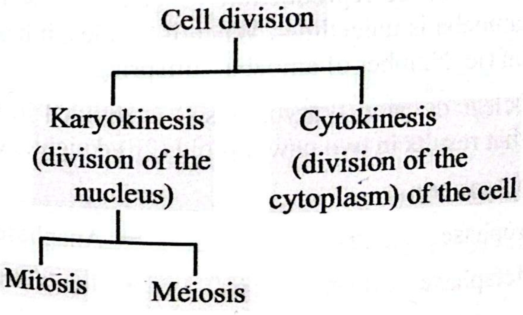
☑ Cell division in unicellular organisms means reproduction.

☑ Cell division is the basic process in all living things where a parent cell (mother cell); divided in to two daughter cells.

☑ Cells on the path to cell division processed through carefully regulated stages of growth, DNA replication, and nuclear and cytopasmic division that finally process two identical (clone) cells.

Cell division

The cell division includes nuclear division called karyokinesis, which is followed by cytoplasmic division called cytokinesis.


Cell division
Karyokinesis (division of the nucleus)
Cytokinesis (division of the cytoplasm) of the cell
Mitosis
Meiosis

I. Mitosis (or M - phase) cell Division

Mitosis:- The process dividing the nucleus in to two daughter nuclei is called mitosis, each of which are the same number of chromosomes.

- During mitosis, the nucleus divides to form two nuclei.
- Each nucleus contains a complete set of the cells chromosomes, The nuclear membrane breaks down briefly. The two sister chromatides of each chromosomes are pulled to the opposite sides of the dividing cells.

Cytokinesis:- as the nucleus divides, the cytoplasm also begins to divide. Each daughter cell receives about half of the original cell's organelles. During cytokinesis, the two daughter cells are physically separated.

Mitosis is a type of nuclear division where duplicated chromosome of a parent cell (mother cells) divided in to two daughter cells. The two daughter cell.

- Having the same number and kind of chromosome as the parent cell and to each other.
- It is identical daughter cells.
- A diploid (2n) mother cell give rise to two diploid (2n) daughtes cells.
- This is duplication of parental cells in to two duplication cells.
- Mitosis cell division results growth, repare, maintenance, replacing dead or worn out cells (or tissues) by the new once in multicellular organisms.
- Mitosis cell division occurs in body cells called somatic cell.
- Mitosis cell division in unicellular organ provide reproduction.
- Mitosis a means of reproduction or getting new offspring. For instance amoeba is unicellular. When it divides, it has increased its population (ie. Number of amoeba - offspring) .

Mitosis as a nuclear division (karyokinesis) is divided in to a series of several phases that results in two new diploid (2n) daughter cells.

These mitosis phases are:-

- Prophase
- Metaphase
- Anaphase
- Telophase

1. **Prophase:-** The first phase: during this phase.
   - Each duplicated chromosome, composed of two sister chromatides and containing identical genetic materials pairs up.
   - The nuclear membrane breaks down, the nucleolus disappears.
   - Chromosomes shorten, thicken and become visible.
   - The centrosome begin to move to opposite poles of the cells, and spindle fibres emerged from the centrosomes (two in numbers).

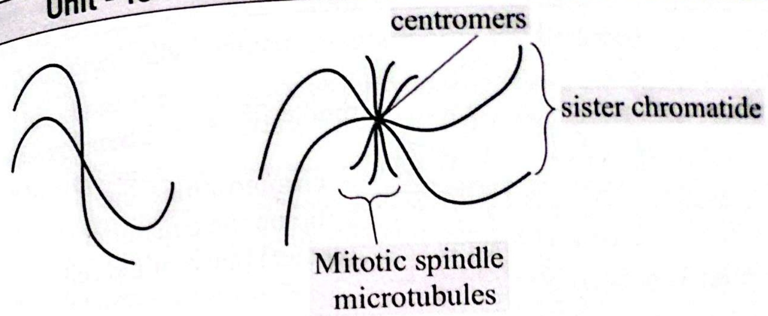


Fig 10.2 Structure of the Chromosome

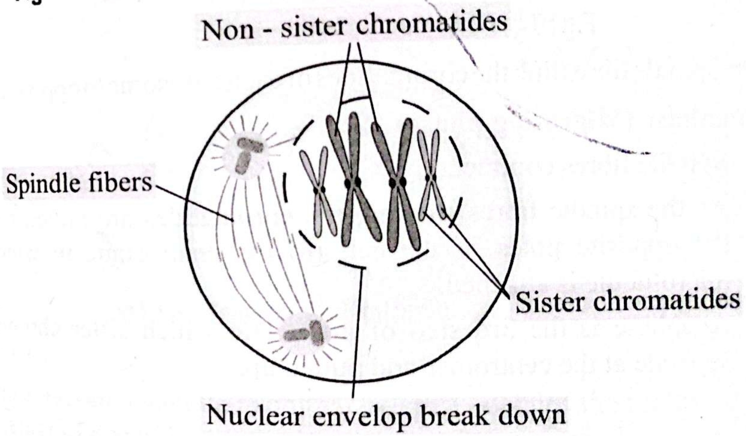


Fig 10.3 Prophase of mitosis

2. **Metaphase (arrangement phase)**
   - During meta phase bivalent or homologous chromosome are arranged theme selves (line up) on the equatorial plane (or meta phase plate) of the cell.
   - The sister chromatides are attached to each other.

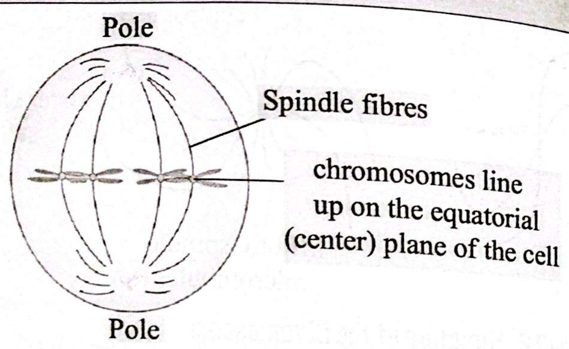

Pole
Spindle fibres
chromosomes line up on the equatorial (center) plane of the cell
Pole

Fig 10.4 Metaphase of mitosis

The spindle fibres link the chromatides of each chrosome to oppoaite poles.

3. Anaphase (Migrating phase)

- Spindle fibres contract.
- As the spindle fibres shorten, the chromatides are pulled towards the opposite poles of the cell (to the centrosome to which it's microtubule is attached.
- Anaphase is the 3rd step of mitosis in which sister chromatides separate at the centromer and pulled up.

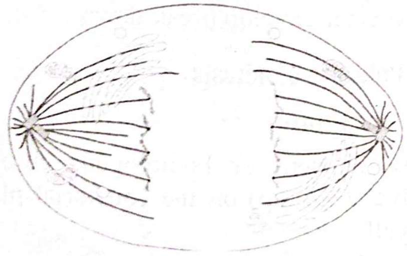


Fig 10.5 Anaphase of mitosis

- Sister chromatides are separated.
- Sister chromatides pulled apart when spindle fibres contract, which drag one chromatid to one pole and the other chromatide to the opposite pole.

4. Telophase (a reverse of prophase).

- Anew nucear envelop forms at each pole. The spindle disolves, and the chromsomes uncoil.

- Cytokinesis (division of the cytopasm). begins.
- Two genetically identical daughter cells are produced.
- This phase is also known as a reversed pro phase because what has disappeared during the inter phase will reappear during the telophase and vice versa.
- Nuclear membrane reappears and surround each set of chromosomes to create two new nuclei arriving at opposite pole.
- Spindle fibres disappears.
- Nuclear division is completed.

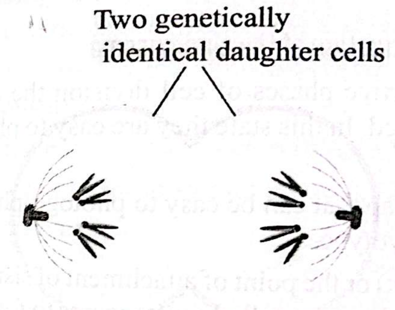


Fig 10.6 Telophase of mitosis

Key terms

Centrosome:- an organelle in animal cell that contains the centrioles and is the center of dynamic activity in mitosis cell division.

Spindle fibres: a net works of micro tubules that forms during mitosis and moves forms during mitosis and moves chromatides to the pole.

- It is long protein fibres extending from structures called centrioles.

Homologous chromosome:- Chromosome appear in pairs. Both members of the pairs are the same shape (or structure) and functions. One coming from each parent in eukaryotes. These homologous pairs of chromosomes are called autosomes. They brought together during fertilization. They are paired.

- Homologous chromosome are two sets of chromosomes.

Sister Chromatids:- Homogous chromosomes consistes of two sets of chromosomes. Each set of chromosome is called chromatid, joined together at the centromer.

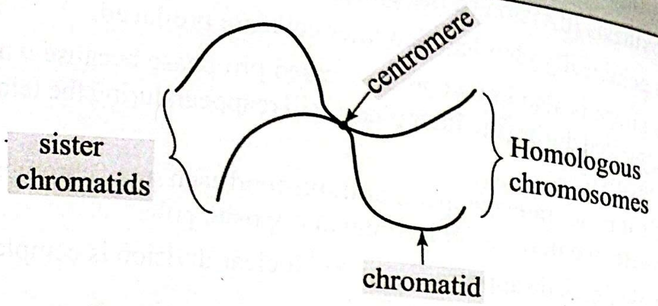

centromere
sister chromatids
Homologous chromosomes
chromatid

Fig 10.7 Structure of the chromosome

Karyotype:- During the active phases of cell division the chromosomes become coiled and condensed. In this state they are easy to photograph and a special display.

- ➥ The chromosomal map that can be easy to photograph and a special display is called karyotype.

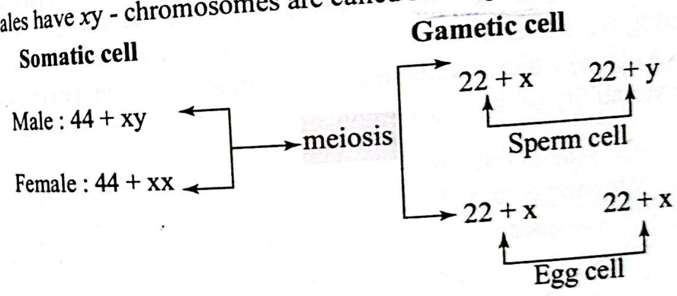
Centromer:- The joint (link) or the point of attachment of sister chromatids They are joined together at the point called centrosomes to form homologus chromosomes.

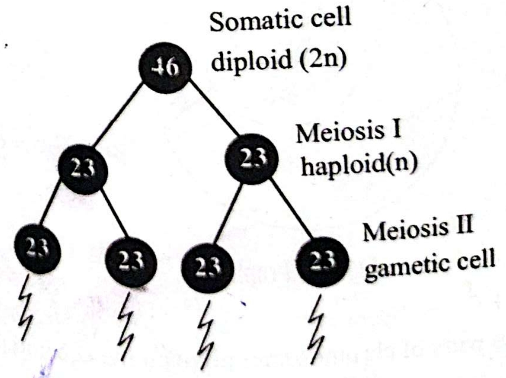
- II. Meiosis

What is meiosis?

- ☑ Meiosis is a nuclear division which involves the formation of gametes (sex cells).
- ☑ Meiosis is a characterstic feature of Sexually reproducing organisms.
- ☑ It occurs in reproductive organisms such as ovaries of female animals, testes (stamen) and ovules (Pistil) of flowering plants.
- ☑ Meiosis involves two fissions of the nucleus giving rise to four gametes or sex cells.
- ☑ Each gamete possess half number of chromosome (n) called haploid (n).
- ☑ Meiosis is called reduction division, ie reducing parental chromosome by half.
- ☑ The body cell in human contain 46 chromosomes (23 pairs of chromosomes) (2n).
- ☑ The 46 chromosomes reduced by half during meiosis and become haploid (n) and contain 23 chromosome in gametic cell.

- ☑ The sperm or egg cell nuclei contain 23 chromosomes, haploid (n).
- ☑ Meiosis carried out a double division. ie meiosis I and meiosis II, resulting four daughter cells.
- ☑ In meiosis I, homologous chromosomes separate and move to opposite cells. This is a reduction by half, goining from diploid (2n) to haploid (n).
- ☑ In meiosis II, sister chromatides separate and move to opposite poles of the cells.
- ☑ Human body cells have 46 chromosomes (23 pairs of chromosomes) in each somatic cells (diploid (2n) body cells).
- ☑ Two of them are sex chromosomes and 44 are auxosomes (non - sex chromosomes).
- ☑ Females have *xx* - chromosomes called homogametic.
- ☑ Males have *xy* - chromosomes are called heterogametic.


Gametic cell
Somatic cell
Male : 44 + xy
Female : 44 + xx
meiosis
22 + x
22 + y
Sperm cell
22 + x
22 + x
Egg cell


Somatic cell
diploid (2n)
46
Meiosis I
haploid(n)
23
23
Meiosis II
gametic cell
23
23
23
23

Meiosis cell division is adouble division That is meiosis I and meiosis II.

Fig 10.8 Meiosis cell division

Meiosis as a nuclear division (karyo kinesis is divided in to as a series of several phases that results in four (4) new haploid (n) daughter cells. These meiosis phases are: prophase, metaphase, anaphase and telophase.

1. Prophase I

Chromosome replicate to form two sister chromatides.

- Nuclear envelop disintegrated
- The chromatides begin to condense and spindle fibres appeared.
- Spindle fibres are attached to the centromere. **centromere** is the point on the chromosome where sister chromatides are joined (or attached).

☑ During prophase I of meiosis I homologous chromosomes paired each other and cross over (exchange of small parts from each other). During cross over one chromosome contain parts of male and female DNA (gene) which results in genetic variation. crossing over increase the variability of the population.

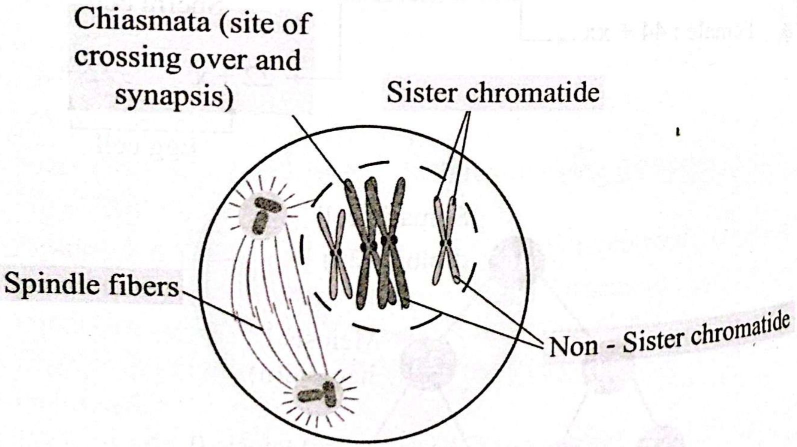

Chiasmata (site of crossing over and synapsis)
Sister chromatide
Spindle fibers
Non - Sister chromatide

Fig 10.9 Prophase I

2. Metaphase I

The homologous pairs of chromosomes align on the equatorial plane of the cell.

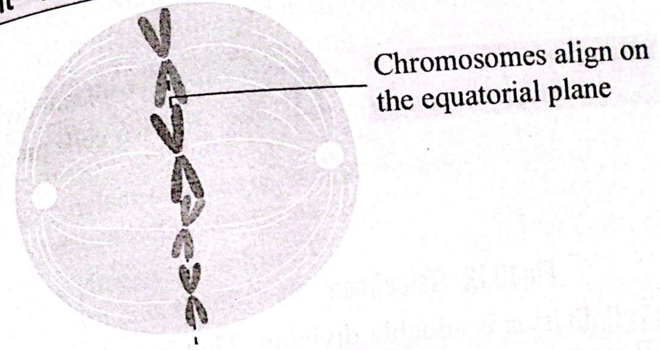

Chromosomes align on the equatorial plane

Fig 10.10 Metaphase I

3. Anaphase I

The homologons pairs of chromosomes are pulled apart by the meiotic spindle and pulled to the opposite pole. This equally divides the DNA.

☑ The sister chromatides stay together (ie. not separt) unlike that happens in meiosis II and mitosis.

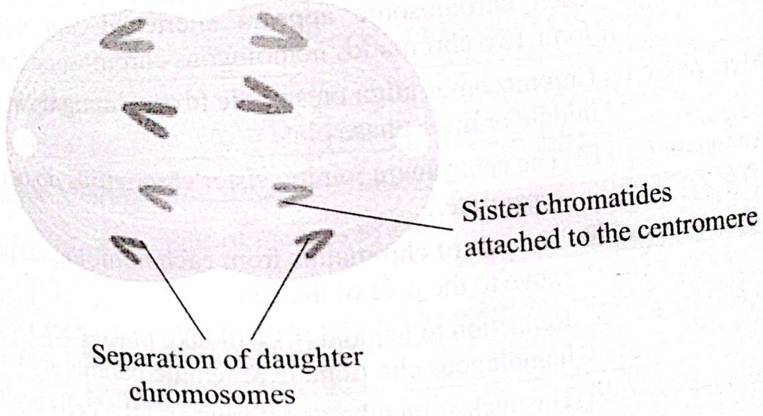

Sister chromatides attached to the centromere
Separation of daughter chromosomes

Fig 10.11 Anaphase I

4. Telophase I (cytokinesis)

- The full sets of chromosomes gather together
- Two separate daughter cells are formed.

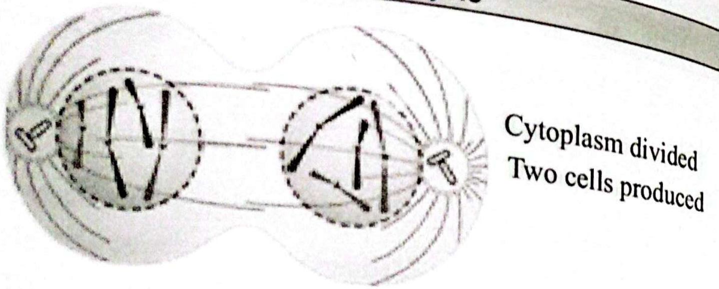


Fig 10.12 Telophase

Meiosis cell division is adouble division. That is meiosis I and meiosis II. meiosis II produces four (4) haploid (n) daughter cells (gametes) prophase II, metaphase II, Anaphase II and telophase II, In telopase II, the four daughter cells are non-idebtical and haploid cells (n).

Table 10 . 1 Description of the Different Stages of Meiosis I and Meiosis II

Stage	Description
Pro phase I	Each chromosome appears shortened and thickened form, two chromatids homologous chromosomes pair up.
Meta phase I	Chromosomes align on spindle fibres; lining up in the middle or meta phase plate
Anaphase I	☑ The centromere joining sister chromatids do not separarate. ☑ The pair of chromatids from each homologous pairs move to the pole of the cell. ☑ Reduction to haploid (n) will take place because homologous chr. of male & female parents separate.
Telophase I	☑ The nuclear membrane reforms and the cells begin to divide. ☑ Cytokinesis begins.
Pro phase II	☑ New spindles are formed and the chromosomes are made up of paired chromatides moves to wards the middle of the cell.
Meta phase II	☑ The chromosomes line up in the meta phase plate, with the spindle attached to the sister chromatides of each chromosome coming from the opposite poles.
Anaphase II	☑ The centromeres divide and sister chromatides separate and pulled to the opposite pole (of each cell.)
Telophase II	☑ Nuclear membarne reapprars, the chromosomes return to the interphase state. ☑ Cytokinesis follows giving four daughter cells, each with half number of chromosome.

10.3 Renowned Ethiopian Geneticist

☑ Genetics is a science of heredity and variation

☑ A scientist that study about genetics is called geneticist.

☑ The objective of this section is to inspire students based on the outstanding contribution of a renowned Ethiopia Geneticist to this profession, to out country and to the whole world.

☑ Dr. Melaku worede (1936 -):

- Worked to save the genetic diversity of Ethiopia's domestic plants.
- He is plant genetics researcher.
- He set up the plan Genetic resources centre in Addis Ababa.

Conceptual Examples With Explanatory notes

1. What is the importance of meiosis to sexually reproducing organism?

Explanation

Meiosis is important to sexually reproducing organisms Because it is a means of getting gametes (or sex cell).

Examples meiosis in human takes place in the reproductive organs called gonads - testes in male and ovaries in female.

- Meiosis a process if gamete formation
- Formation of gametes called gametogenesis.
- Meiosis in male which form male gametes is called spermatogenesis.
- Sperma to genesis is formation of sperm cell.

- Meiosis in female for the formation of egg (ova) is called oogenesis.

2. Mention at least two important features of cancer cells?

Explanation

Unlike normal cells, cancerous cells have the following features.

- They have limitless replicative potential
- They do not stop growing and dividing.
- This uncontrolled growth results in the formation of tumour.
- They are insensitive to growth inhibitors (anti growth) signals.
- They have the capacity to migrate and invade other tissues & organs resulting in their spread through out the body.

3. What is the difference between inter phase and pro phase?

Explanation

Inter phase is a separate phase that takes place before mitosis.

- The cell shows growth, DNA synthesis and replication of genetic matarial takes place.
- Metabolic changes assemble the cytoplasmic materials necessary for mitosis and cytokinesis occurs during inter phase.

Prophase is one of the four phases of mitosis where

- Duplicated chromosomes, composed of two sister chromatids and containing identical genetic materials paired up.

4. What would happen if there is no cytoplasmic division at the end of telophase.

Explanation

If there is no cytoplasmic division occuring at the end of telophase the division will not end by giving daughter cells.

5. If a cell have 2n = 46 divided by meiosis.

A. If a cell have 2n = 46 divided by meiosis

Explanation

There will be two cells at the end of meiosis I and four cells at the end of meiosis II

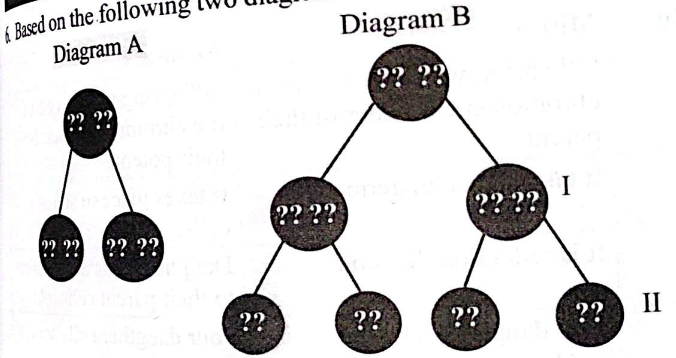
B. How many chromosomes are there in each daughter cells at the end of meiosis I? meiosis II?

Explanation

C. There will be 46 chromosomes in each daughter cells at the end of meiosis I and 23 chromosomes at the end of meiosis II.

Illustrative Example note

6. Based on the following two diagrams of cell division



7. Which of the following is true about diagram A and B?

A. Diagram B is meiosis cell division

B. Diagram A is meiosis cell division

C. Diagram B is the division of somatic cell

D. Diagram A is the division of a germ cell.

Explanation

In mitotic cell division daughter cells have same chromosome number as a parent cell. While, in meiosis the dughter cells contain half the chromosome number of their parent cell. Meiosis has a double division ie. Meiosis II and Meiosis I

Answer: A

8. During meiosis I, in which phase does each chromosome appear in condensed from with two chromatids?

A. Anaphase - I

B. Telophase - I

C. Prophase - I

D. Meta phase - I

CS CamScanner

Explanation

During prophas - I of meiosis;

- Chromosome appear in a condensed form
- Nuclear envelope disappears.
- Homologous chromosomes synapse

Answer: C

9. This item is based on the following table which shows the comparison between mitosis and meiosis cell division.

No	Mitosis	Meiosis
1	Off spring will have the same chromosome number of their parent	Off spring will have half the chromosome number of their potent
2	It takes place in germ cells	It takes place in somatic cells.
3	It is reduction division	Daughter cells are identical to their parent cells.
4	Two daughter cells are produced	Four daugther cells are produced

Which of the above comparison is correctly matched?

A. 1 and 2 B. 1 and 5 C. 1 and 4 D. 1 and 3

Explanation

Mitosis	Meiosis
Offspring have the same chromosome number as their parent	Off spring have half the chromosome number of their parent
It takes place in somatic cells	It takes place in germ cells
It is equational division	It is reduction division
Two daughter cells are produced	Four daughter cells are produced

10. What is meiosis? It is a division of

A. Brian cells

B. Blood cells

C. Sex cells

D. Haploid cells

Explanation

Meiosis is a division of germ cells to form gametes such as sperm cells and egg cell

Answer: C

11. What is mitosis? It is:

A. Formation of sex cells C. Division of somatic cells

B. Copying of chromosome D. Formation of zygote

Explanation

Mitosis is the division of somatic (body) cells.

Answer: B

12. What is the stage of meiosis where a pair of chromatids moves to opposite poles?

A. Prophase I B. Anaphase I C. Anaphase II D. Metapfase II

Explanation

During anaphase II

- Sister chromatids separate and chromosomes move to opposite poles.

Answer: C

13. Which of the following happens both in mitosis and meiosis?

A. Two divisions following one another

B. Separation of sister chromatids

C. Separation of sister chromatids

D. Reduction of chromosome number by half

Explanation

Both meiosis and mitosis involve the separation of sister chromatids.

Answer: B

14. What is the amount of DNA in a gamete cell?

CS CamScanner

A. One fourth of the mother cell
B. Four times that of the mother cell
C. Half of that of the mother cell
D. Twice that of the mother cell

Explanation

Gamete cells like sperm and egg cell contain half the chromosomal number of the parent cells chromosome number There fore, the amount of DNA in gamete cell is half of that the mother cell .

Answer: C

15. Identify the stages in cell cycle, and describe the principal events

Explanation

Cell cycle is a cycle series of event in the life of dividing cell. It consists of mainly.

- In terphase - the preparatory stage of cell division, that consists of:
    - Intersive cellular cynthesis (G1)
    - DNA replication (s)
    - Mitotoc spindles begin to form (G2)
- Mitosis (m) - nuclear divison occurs in four phases namely. prophase, metaphase, an aphase and telophase.
- Cytokinesis (c) - cytoplasmic division

16. The two halves of a replicated chromosome are called
A. Spindle fibers
B. Chromatids
C. Centromerse
D. Centrioles

Explanation

Sister chromatides are held together by a structure called centromere. There fore, each of sister chromatids is called chromatids

Answer: B

17. The correce order of the stages in mitisis is
A. Metaphase → Anaphase → Telophase → prophase
B. Prophase → Anaphase → Telophase → Metaphase
C. Metaphas → Telophase → Anaphase → Prophase

D. Prophase → metaphase → Anaphase → Telophase

Explanation

The correct order of stage in mitosis is
Prophase → Metaphase → Anaphase → Telophase

Answer: D

18. Which of the following sentences explain how crossing over brings variation? (ESSLCE Hamlie 2015 E.C)
A. In meiosis I, their is splitting up of pair of homologous chrmosome & line up.
B. In meiosis I, their is exchange of a section of DNA between chromatids
C. In meiosis II, homologus chromosomes align them selves independent of other cells
D. In meiosis II, chromatides from each chromosome are separated at random.

Explanation

During prophase I of meiosis I, non - sister chroma tides exchange the section of DNA from each other, which results in genetic variation. There fore, one chromosome contain male and female DNA. This increase population variation

Answer: B

19. In which of the stages of mitosis do sister chromatids line up along the equatotial plane of the cell?
A. Prophase
B. Telophase
C. anaphase
D. Metaphase

Explanation

Prophase	Chromosome became short and thick nuclear membrane disintegrate
Metaphase	Sister chromatids line up on the equator
Anaphase	Centromer split and the spindle fibers and chromatids move to the opposite poles
Telophase	Chromosones become longer and thin nuclear membrane reappears

Answer: D

20. In mitotic cell division duplication of chromosomes occurs in:

A. Metaphase
B. Telophase
C. Interphase
D. Prophase

Explanation

Interphase is the longest phase of cell cycle, where the duplication of chromosomes takes place.

Answer; C

21. During cell division centrioles are from

A. Nucleus
B. Spindle fibers
C. Cenromeres
D. Nucleotides

Answer: B

22. Rearrange the following phases of the cell in a cell cycle in their correct order:

Metaphase
Interphase
Anaphase
Prophas
Cytokinesis
Telophase

Explanation

The correct order of phases in a cell cycle are

Interphase → Prophase → Metaphase → Anaphase → Telophase

Conceptual Example

23. Describe the meaning of

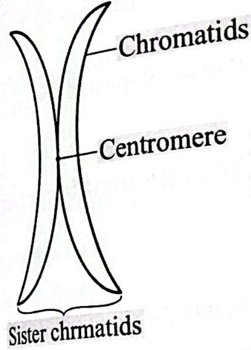
- Oogenesis
- Spermatogenesis

Explanation

- Oogenesis:- is the meiotic process of egg formation
- Spermatogenesis:- is the process of sperm formation.

24. Describe the structure of duplicated chromosome including the siter chromatids and centromeres.

Explanation



Sister chromatide each chromatids come from the parent (one from each parent) and joined at a point called centromere.

- ➢ Forming homologous pair of chromosome.
- ➢ They are a copy of one anther.

25. Explain the significance of mitosis, and describe the process

Explanation

Mitosis is significant for

- Growth of the body
- Replacement of damaged and worn out cells.
- A sexual reproduction

26. Distingush between haploid and diploid cells

Explanation

- Haploid are cells that have half the chromosome number of a parent cell. The are represented by n. Examples are sperm and egg sells.
- Diploid - are that contain full set of chromosome. They are represented by 2n

27. Examples are all the body cells other that sperm and egg cells.

- Define
  - Homologous chromosome
  - Sister chromatides.

Example

- Homologous chromosomes - are chromosome that are similar in morphology and genetic composition. They are of identical chromosome incorporated from both parents.
- Sister chromatids - are chromosome that are copies of one another.

End of unit Review Exercise

Part I True/False Items say True if the statement is correct or False if the statement is incorrect.

1. It is meiosis I resembles mitosis
2. Homologous chromosomes are duplicated one parent chromosome.
3. Meiosis results in four haploid daughter cells.
4. DNA duplication is the longest phase of the inter phase.
5. Prokaryotic organisms like bacteria do not divide by mitosis.

Part II Matching Items

Match the terms under column B with the description under column A

A	B
6. Known as cytoplasmic division	A. Anaphase
7. Paired paternal and maternal chromosomes	B. Cytokinesis
8. Pulled chromosomes to the opposite ends of a cell	C. Homologous chromosomes
9. Arrangements of chromosome at the metephase plate	D. Inter phase
10. Separation of sister chromatids	E. Meta phase
11. Duplicated one parent chromosome	F. Sister chromatids
12. Chromosomal map that can easy to photograph and display	G. Spindle fibres
13. An organelle in animal cell that contains the centrioles and it is the centre of mitosis	H. Telophase

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14. The chromatids joined (linked) together at the point to form homologous chromosomes	I. Karyotype
	J. Centromere
15. Reductional division	K. Centrosomes
	L. Haploid (n)

Part III. Multiple Choice Items

16. Growth of body tissues is a result of:
A. Mutation C. Metamorphosis
B. Meiosis D. Mitosis

17. If a cell having 8 chromosomes is divided by meiosis, which of the following is untrue?
A. The daughter cells have 4 chromosomes each
B. Four daughter cells are produced
C. Somatic cells are produced
D. Haploid cells are produced

18. The correct order of stages in meiosis is:
A. Prophase → Anaphase → Metaphase → Telophase
B. Anaphase → Telophase → Metaphase → prophase
C. Metaphase → Anaphase → prophase → Telophase
D. Prophase → Metaphase → Anaphase → Telophase

19. The preparatory stage of cell division is
A. In terphase B. Cytokinesis C. Anaphase D. Karyokinesis

20. What is the number of chromosome in a human fertilized egg?
A. 23 pair B. 23 C. 46 pair D. 92

21. The stage of cell division where nuclear membrane and nucleolus disappears is
A. Prophase B. Metaphase C. Anaphase D. Telophase

22. The longest phase of the cell cycle is
A. Prophase B. Cytokinesis C. Interphase D. Mataphase

23. The division of nucleus during the process of cell division is called

A. Cytokinesis
B. Karyokinesis
C. Crossing over
D. Breaking over

24. Nuclear division occurs during which stage of the cell cycle?
A. G1 phase
B. S phase
C. G2 phase
D. M phase

25. All the body cells except sex cells are called:
A. Gametes
B. Somatic cells
C. Autosomes
D. Germ cells

26. All of the following are the importance of mitosis except one which is it?
A. Growth of the body
B. Sexual reproduction
C. Replacement of worn out cells
D. A sexual reproduction

Part IV Fill in the blanks

Fill in the following blank spaces using an appropriate answer from the list given

Meiosis
Replication
Centromere
Game to genesis

Diploid
Sister chromatids
Cytokinesis
Crossing over

Haploid
Meiosis I
Meiosis II

27._____ is the process by which a DNA molecule makes it's own copy.

28. A cell that contains full set of chromosomes is ______ while those with half set of chromosome are called ______ .

29. The point of attachment between sister chromatids is known as ____

30. _______ are identical pair of chromosomes formed when a chromosome are copied.

31.________ is the process by which sperm and egg cells are formed

32. The division of cytoplasm is called ______ .

33.________ is the process by which sperm and egg cells are formed.

34. The process by which exchange of genetic materials occurs between homologous chromosomes is called ______ .

35.______ involves separation of homologous chromosome: while, ___ involves the separation of sister chromatids.

Answer Keys

For End of unit Review Exercises

Part I. True/ False Items

1. False 2. False 3. True 4. True 5. True

Part II. Matching Items

6. B. Cytokinesis
7. C. Homologus Chromosome
8. G. Spindle fibres
9. E. Metaphase
10. A. Anaphase
11. F. Sister chromatides
12. I. karyotypes
13. K. Centrosomes
14. J. Centromers
15. L. Haploid (n)

Part III. Multiple choice Item

16.D 18.D 20.A 22.C 24.D 26.B
17.D 19.A 21.D 23.B 25.B

Part IV Answer keys for fill in the blanks spaces

27. Replication
28. Diploid/Haploid
29. Centromere
30. Sister chromatides
31. Meiosis
32. Cytokinesis
33. Gametogenesis
34. Cross over
35. Meiosis I/ Meiosis II

UNIT 11

Human Biology

11.1 The Digestive System

Introduction

All living organisms need nutrients to survive. Animals obtain their nutrients through consumption of other organisms At the cellular level, the biological molecules necessary for animal functions are :

- Simple sugar
- Amino acids
- Lipid molecules
- Nucleotides

However, the food consumed consistes of proteins, Lipids and the complex carbohydrates.

☑ Animals must convert these macromolecules in to simple molecules required for maintaining cellular function.

☑ The convention of the food consumed to the nutrients required is a multi - step process involving digestion and absorption.

Digestion : the process in which large, complex and insoluble food particles are changed to their smaller, simpler and soluble forms, which are later absorbed by the body for cellular use is called digestion.

The Process of Digestion is made by :

- Physical (Mechanical) digestion and
- Chemical digestion

i. The Physical / Mechanical digestion

It involves breaking down of large food particles in to smaller pieces by :

- The grinding and chewing actions of the teeth in the mouth.
- The roling action of the tongue
- The peristalsis movements of the food along the gut.
- The emulsification of fats in to tiny fat dropletes by the bile

The physical digestion provides much more surface area for the digestive enzymes.

ii. Chemical Digestion

Chemical digestion involves converting food particles in to smaller, simpler and soluble forms by the hydrolysis reaction which is mediated by enzymes. It is enzyme - catalysed reaction

- Chemically digested food can be easily absorbed in to the body and used up.

The human digestive system is composed of five digestive processes. These are :

- Ingestion
- Digestion
- Absorption
- Assimilation
- Egestion/ Defication.

i. **Ingestion :** The process by which food is taken in to the mouth is called ingestion

ii. **Digestion :** The process of breaking down of large and complex organic molecules in to smaller and simpler components by physical and chemical process is called digestion.

iii. **Absorption :** The transport of digested nutrients from the small intestine to the blood stream (in to the circulation)

- A small, finger - like projection on the inner wall of the small intestine called villi, absorb digestive end products of food in to the blood stream

iv. Assimilation : The ultimate uses of digestive end products of food, either for sources of energy or to be incorporated in to new parts of a cell.

v. Egestion : The removal of undigested food (roughage) wastes from the body in the form of feaces is called egestion (or defication).

- ➥ The undigested food that remains after digestion is removed (expelled) in animals during the egestion process.
- ➥ Egestion is different from excretion .
- ➥ **Excretion** is the process by which metabolic waste products from the cell are expelled in both plant and animal cells.

The gut is a hollow tubular structure called alimentary canal which extends from mouth to anus.

It includes the following path way:

Mouth → Oesophagus (gullet) → Stomach → Small intestine → Large intestine → Rectum → Anus.

The Oral Cavity

Digestion in the Mouth

What is the process of digestion that takes place in the mouth ?

Mouth is the anterior Depending of the alimentary canal and is bounded by the lips.

- ➥ The food enters the body through the mouth (Ingestion) is bitten by the teeth in which it is broken down in to smaller pieces by its chewing action. This process is known as mastication .
- ➥ The cavity inside the mouth that consistes of teeth and tongue is called buccal cavity.
- ➥ In the mouth both the physical and chemical digestion starts.

The physical digestion : It is carried out by the :-

- ➥ Grinding and chewing action of the teeth
- ➥ The rolling action of the tongue in the mouth

The main reason for chewing is to break down the food in to smaller pieces making it easier to be swallowed and increase the surface area for enzyme action.

The chemical digestion in the mouth : is carried out by the action of the enzyme called salivary amylase (or ptyalin)

E g Starch Food $+ H_2O \xrightarrow{\text{Ptyalin}}$ Maltose

Saliva : Saliva is produced by the salivary glands

- Saliva contain : Enzyme
- Water and
- Mucus

☑ The enzyme called salivary amylase (ptyalin) digest starch chemically in to maltose

☑ Maltose is the first products of chemical reaction in the mouth. It is sweet taste.

☑ Some solid foods dissolved by the water in the saliva

☑ The mucus in saliva stick digested food together to form bolus. It is the tongue position and mixes food and form the bolus ready to be swallowed.

Bolus : is aball - sheped swallowed mass of food from the mouth along the oesophagus to the stomach is called bolus.

☑ The swallowed food from the mouth enters the oesophagus or food tube, and is moved to the stomach by the rhythemic muscular action.

Peristalsis : The movements of food down the oesophagus by the rhythemics contraction and relaxation of muscle so as to push the food is called peristalsis .

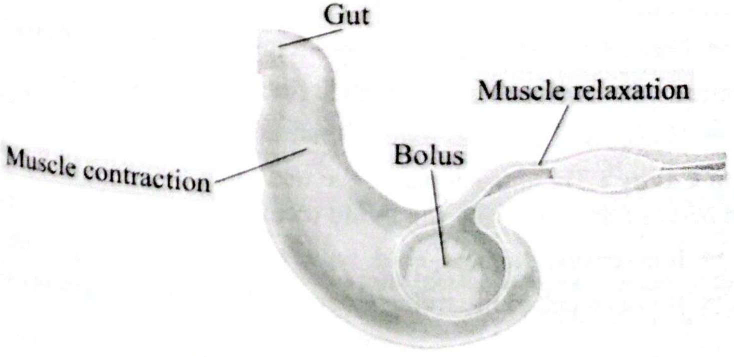


Fig 11.1 Peristalsis

☑ Peristaltic action will move food or fluid from the oesophagus to the stomach.

☑ Peristalsis is a waves of muscular activity.

☑ The peristaltic activity occurs through out the gut (the alimentary canal or canal)

☑ Peristaltic contractions, which are involuntary action,move food along the gastrointestinal tract.

The Teeth

Teeth have evolved to be very strong and are important to animals in obtaining and initial digestion of their food .

The External and Internal Structure of Teeth

The longitudinal section of the teeth has the following parts

Crown : The exposed portion of the teeth above the gum.

Root : The part which is embedded in the jaw bone.

- It holds the teeth in its place.

Neck : the narrow region between the root and the crown.

Cement : the structure that firmly attaches the root in to the gum.

Periodontal Ligament : tissue that helps to hold the teeth tightly against the jaw.

The transfers (cross - sectional) area of the teeth consistes of three layers These are :

Enamel : The structure that covers the crown and neck of tooth. It is the outer, white layer

- Enamel is the hardest structure in human body . It protects the teeth.

Dentine : the hard substance which is found next to enamel.

- However, it is not as hard as enamel.

Pulp Cavity : The inner layer of the teeth that consistes of blood vessels and nerves fibre supplying the living teeth.

- It is sensitive to heat, cold, pain, e t c
- It is also called the living tissues of the teeth.

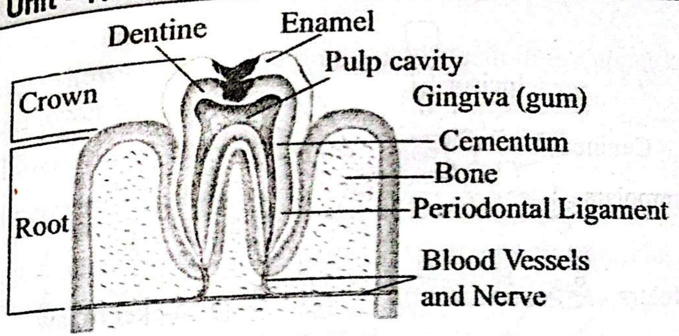


Fig 11.2 The Structure of human teeth

Types of Teeth

Different teeth are specialized for different functions In mammals including human consistes of four different types of teeth which vary based on there shapes and functions These are :

i. **Incisors (I) :** are eight front chisel - shaped teeth at the front of your mouth specialized for biting and cutting lamp of food

- They function as scissors

ii. **Canine (C) :** teeth that are sharp, dagger shaped specialized for tearing.

- It is sharp and pointed teeth which is used for biting, piercing and tearing flesh (meat)
- They function as pincers .

iii. **Premolar (P) :** teeth that are broad, flattened specialized for grinding chewing food and crushing .

iv. **Molar (M) :** teeth tend to be even broader and have cusps that are even more flattened than premolar .

- It is specialized for grinding crushing and chewing food . It is similar in function with premolar.

The last set of molar teeth are the wisdom teeth, so called because they usually do not emerge until we reach about the age of 16 to 20 years old.

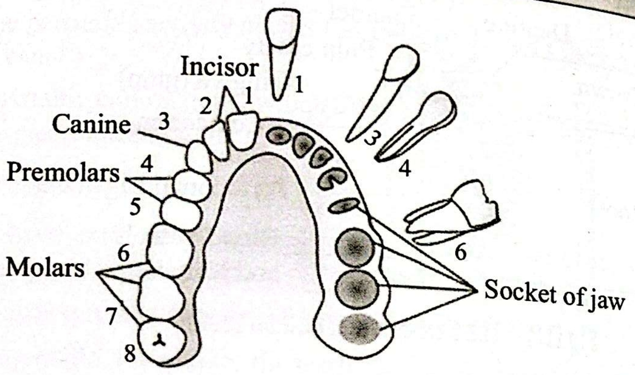


Fig 11.3 The type of teeth in human

The Human Dentition

What is dentition ?

The arrangement of teeth on the Jaw of human is called dentition.

Mammals including humans have two sets of teeth in their life These are :

➥ Milk teeth ➥ Permanent teeth

1. Milk teeth : is temporary teeth

➥ It is replaced by permanent teeth.

➥ There are 20 teeth in children

➥ Milk teeth is called deciduous teeth grown at the age of 6 in human.

☑ The lower incisors are the first to grow out in children.

Dental formula of milk teeth :

$$I\,\frac{2}{2}\,C\,\frac{1}{1}\,P\,\frac{0}{0}\,M\,\frac{2}{2} = \frac{2+1+0+2}{2+1+0+2} = \frac{5}{5} = ;\ \frac{5\times 2}{5\times 2} = \frac{10}{10}$$

∴ The total milk teeth = 10 + 10 = 20 teeth

2. Permanent teeth : is adult teeth.

➥ It is not replaced if once decayed or fall out .

➥ They are 28 teeth at the age of 20 - 25 years old.

➥ Four additional teeth grown called wisdom teeth and total permanent teeth have 32 in the permanent dentition.

☑ The number, type and arrangement of teeth can be calculated by the dental formula.

Dental formula shows the number and type of teeth in the upper half the jaw and in the lower half of the jaw.

The dental formula of Adult man (permanent teeth) are :

$I\frac{2}{2}C\frac{1}{1}P\frac{2}{2}M\frac{3}{3}$ The total number of teeth or dentitions can be Calculated as :

➥ First add the number of teeth in the upper and in the lower jaw and then multiply each jaw by two finally sum up the product.

$$\frac{2+1+2+3}{2+1+2+3} = \frac{8}{8}\ ;\ \frac{8\times 2}{8\times 2} = \frac{16}{16}$$

The total teeth of adult man = 16 + 16 = 32 teeth. Both human beings and monkeys have the same set of teeth and the same dental formula.

The dental formula of a dog is :

$I\frac{3}{3}C\frac{1}{1}P\frac{2}{3}M\frac{4}{4}$ To calculate the total number of teeth in a dog is

$\frac{3+1+2+4}{3+1+3+4} = \frac{10}{11}\ ;\ \frac{10\times 2}{11\times 2} = \frac{20}{22}$ The total teeth of dog = 20 + 22 = 42 teeth.

Keeping Teeth Health

Teeth can be easily exposed to bacterial infection. This is because bacteria can easily get the sugar food which is dissolved with saliva in the mouth. They form a thin film known as **plague** . These bacteria produce acid that can dissolve the enamel and dentin ; finally they reach the inner sensitive layer of the teeth called pulp cavity, results in teeth ache or pain. It also make the teeth to become discoloured.

The condition in which the teeth become painful and discoloured is called tooth decay.

Periodontal disease : the bacterial infection of the gums which causes bleeding and loss of teeth is called periodontal disease.

The teeth should be kept clean and healthy by :

- ☑ Regular brushing of teeth and gums twice a day This removes the plague from the teeth, preventing the building up of a sticky acidic film over the enamel.
- ☑ A voiding sweet,sugary food.
- ☑ Regular dental - check ups.

Conceptual Example

1. Distinguish between physical (mechanical) digestion and chemical digestion.

Explanation

Mechanical (or physical) digestion is the process of cutting, grinding, breaking , or rolling large food particles in to smaller pieces.

Example crushing, grinding or cutting food by teeth in the mouth, rolling it by the tongue, emulsifying fatty food by the bile in the duodenum are physical digestions .

Chemical digestions are the process of changing insoluble and complex food particles chemically in to smaller pieces by enzymatic action.

2. List out the layers of human teeth from outer to the inner one.

Explanation

Enamel → Dentine → Pulp cavity.

3. Given the dental formula of a cow $I\frac{0}{3}C\frac{0}{1}P\frac{3}{3}M\frac{3}{3}$ calculate the total number of teeth.

Explanation

The dental formula of dentition shows the upper half of the jaw and the lower half of the jaw.

- ➥ Add up the number of teeth in upper and in the lower jaw and multiply each jaw by two

$$\frac{I\,0+C\,0+P\,3+M\,3}{I\,3+C\,1+P\,3+M\,3} = \frac{6}{10},\ \frac{6\times 2}{10\times 2} = \frac{12}{20}$$

Finally sum up thelower and upper Jaw product

The total teeth of a cow is 12+20 =32 teeth

4. Mention some methods of keeping the teeth clean and healthy ?

Explanation

- ➥ Regular brushing of teeth and gums twice a day and removing plague from the teeth
- ➥ Avoiding sweet and sugary foods
- ➥ Regular dental - check ups.

5. Which type of teeth is used for biting and tearing food ?

Explanation

Carnivore teeth is adapted to biting and tearing flesh food called canine. Canine is a type of teeth which is sharp and pointed teeth adapted to bite and tear flesh meat in carnivores and omnivores.

6. What is plague and it's effect on tooth decay ?

Explanation

Plague is a thin film of sugary foods formed on teeth where bacteria can easily get it and grow on it. These bacteria produce acid that can dissolve the enamel and dentin which causes tooth decay

7. Name the three layers of the cross sectional area of the teeth.

Explanation

Enamel,dentine and pulp cavity are the three layers of the cross sectional areas of the teeth.

Enamel = is the white, outer part and the hardest structure in the body.

Dentine = It is found next to the enamel, but not as hard as the enamel.

Pulp cavity = is the inner most layer of the teeth, which is sensitive layer that consistes of blood vessels and nerve endings. It is sensitive to heat, cold, pain,e t c.

8. What is the difference between ingestion and digestion ?

Explanation

Ingestion is the process of taking and putting food items in to the mouth.

Digestion is the process of changing larges complex and insoluble food particles in to smaller, simpler and soluble forms.

9. Describe the difference between bolus and peristalsis ?

Explanation

Bolus is a ball - shaped, swallowed mass of food from the mouth along the oesophagus to the stomach.

Peristalsis is the wave - like contraction and relation of muscle so as to push the food along the alimentary canal is called peristalsis.

10. What is assimilation ? Explain

Explanation

The ultimate uses of absorbed food is either used as the sources of energy or to be incorporated in to a new cell and become parts of a cell is called assimilation.

11. What are the functions of saliva ?

Explanation

Saliva moistens the food we eat and contains salivary amylase that digest carbohydrates such as starch in the mouth.

12. Where in the alimentary canal physical and chemical digestion begin ? Explain

Explanation

The digestive tract of adult human is 6.5 m to 9 m long. It stores and breaks down organic molecules in to simpler components. The physical and chemical digestion begins in the mouth, where the breaking down of the food entering the mouth in to smaller pieces by our teeth is the physical digestion. The conversion of starch food in to maltose by the action of ptyalin is the chemical digestion.

13. Mention the different types of teeth ?

Explanation

There are four different types of teeth. These are Incissor, canine, pre molar and molar that perform different activities .

14. Mention the functions of different types of teeth in human ?

Explanation

Incisors : eight chisel - shaped teeth at the front of the teeth which is specialized for cutting .

Canine : teeth that are sharp, dagger - shaped specialized for tearing

Premolar : teeth that are broad flattened specialized for grinding.

Molar : tend to be even broader and cusps that are even more flattened. It is for crushing food wisdom teeth that do not merge until we reach about the age of 16 to 20 years of age. Each teeth covered by the hardest substance in human body called enamel.

15. Mention the reasons for teeth decaying ?

Explanation

- Bacteria in the mouth feed on sugary, starchy foods and drinks. E g sugar , fruits, candy, bread, cereals milk and juices.
- Bacteria, acid, food and saliva mixe to form plague.
- With out the proper brushing and flossing, acids in plague dissolve tooth enamel, creating cavity or holes

16. How does chewing assist in the digestion of food ?

Explanation

Chewing breaks down the food particles making them ready for chemical digestion.

17. What are amylase enzymes and why are they necessary ?

Explanation

Amylase is a hydrolytic enzyme that breaks carbohydrates in to lower grades (intermediate products) such as disaccharides (E g - maltose)

18. Mention how food moved along the oesophagus ?

Explanation

After food digested in the mouth it traves to the stomach by ways of the oesophagus.

The Bolus of food stretche the walls of the oesophagus, activating the muscle like a wave of rhythmic contractions, involuntary action, move food along the gastro intestional tract. The perstaltic action will move the food from the oesophagus to the stomach.

19. Categorize the following enzymes in to the reaction they catalyse and the organs in which the reaction takes place.

Explanation

Enzymes	Reaction catalysed	Organ
Amylase	Starch + H_2o → Maltose	Mouth and duodenum
Lipase	Lipids → fatty acid and glycerol	Duodenum and ileum
Maltase	Maltose → glocose molecules	Ileum
Trypsin	Peptones → peptides	duodenum

Digestion in the Stomach

The stomach is the site of food storage and the initial protein digestion. Stomach is the principal organ for protein digestion.

The stomach contain three layers of muscles, which runs in different directions so that the muscle contractions can churn the food.

The movement of food to and from the stomach is regulated by circular or ring muscles called sphincters. Sphincters act like the draw strings on a bag.

The lower eosophageal sphincter (L E S) : the contraction of the LES closes the opening to the stomach. While the relaxation of the L E S allows food to enter from the mouth through the eosophagous.

- The L E S prevents food and acid from being regurgitated up in to the oesophagos

The Pyloric Sphincter Muscle:

- Regulates the movements of food and stomach acid in to the small intestine.
- Muscle is responsible for the contractions of the stomach.
- Sphincter muscles regulates the movements of food
- The J - shaped stomach has numerous ridges that allows it to expand so that it can store about 5 liters of food.

Activities in the Stomach

The inner wall of the stomach have different activities .These are :

1. The secretion of stomach fluids called gastric juices, that aid digestion.
2. The contraction and relaxation of stomach mix the food with gastric juices.
3. It involves both the physical digestion (the churing action of the muscular stomach wall which mix the food and the chemical Digestion (digestion of protein by an enzyme pepsin) is brought about by the stomach.

The compositions of Gastric Juices includes :

1. Hydrochioric acid (H C l)
2. Enzymes
3. Mucus

1. Hydrochloric acid (H C l)

- It neutralizes the functions of salivary amylase (ptyaline) that come from the mouth. It denatures the ptyaline enzyme.
- It provides acidic medium for best functions of enzymes in the gastric juices.
- It kills pathogens (bacteria) swallowed (ingested) with food.
- It also converts the inactive Pepsinogen in to active enzyme called pepsin
- The PH inside the stomach normally ranges between PH = 2.0 to 3.0 but many approach PH 1.00

Acid with PH 2 can dissolve fibres in a rug.

2. **Enzymes :** Gastric Juice also contain enzymes called pepsine and Rennin

Pepsin Enzyme :- The gastric wall (the stomach lining) Secretes the enzyme pepsin as in the form of pepsinogen.

- The dilute hydrochloric acid brings about the conversion of pepsinogen in to pepsin.
- Pepsin is an enzyme which catalyse the hydrolysis of protein in to polypeptides (peptones and proteoses).

$$\text{Protein} \xrightarrow{\text{Pepsin}} \text{Peptones and proteoses}$$

- Pepsin breaks the long amino acid chains in proteins in to a short chains called polypeptides
- These polypeptides are called peptones and proteoses.

$$\text{Protein} + H_2o \xrightarrow{\text{Pepsin}} \text{Peptones and Proteoses}$$

- Enzymes that are used to catalyze digestion of proteins are called protease enzyme .

Rennin : In young mammals rennin is needed to coagulate the soluble protein in milk.

- The coagulated (solidified) soluble milk protein is called **casein.**
- Casein is digested by protein - digesting enzyme called **pepsin**
- The solid curd (solidified milk) stay in the stomach much longer than the liguid milk, making digestion more effective.

3. **The Mucus :** A layer of alkalin mucus protect the stomach lining from being digested by pepsin (protein - digesting enzyme). since the stomach wall itself is made up of protein.

- The pepsin break down the protein food but not the protein of the stomach's cell. Because these cells are protected by the mucus layer.
- The Eosophagus does not have protective mucus layer, so if the L E S (the lower oesophageal sphincter is weak, stomach acid may enter the oesophagous and damage it's lining.

This causes pain in the inner chest called heart - burn.

Chyme : The soup - like uniform creamy paste is called **chyme.**

- Chyme is produced by the physical and the chemical digestion in the stomach.

- The physical digestion which is caused by the churning movements of the muscular walls of the stomach which mixe the food and gastric juices thoroughly and also help reduce the food to a uniform creamy paste known as chyme. Food stays in the stomach on average for about 4 hours, although this depends on type of food taken in.

☑ The movement of chyme is regulated by

- Hormones
- Stomach distention
- Muscular reflexes that influence
- The pyloric sphincter.

The presence of food in the stomach also causes the release of the hormone called gastrin.This Also stimulates the production of acidic gastric juice. When food enters the stomach both acid and pepsinogen are released largely.

☑ Once the stomach has turned all the food to chyme, it releases the paste a litle at a time in to the duodenum by the opening and closing of the pyloric sphincter.

Absorption in the stomach

☑ Stomach absorbs few of the products of digestion.

☑ Stomach can absorb many other substances, which includes water, specific vitamines , alcohol and some medicines.

The Small Intestine

Most chemical digestions takes place in the small intestine Digestion of food completed and absorption of digestive end - products takes place in the small intestine.

Parts of the small Intestine

1. **Duodenum :** The first parts of the small intestine
   - The first 25 - 30 cm of the small intestine where the majority of digestion takes place.
   - The pancreatic juices and bile acts on food in the duodenum from pancreas and liver.
2. **Jejunum :** is the second component of the small intestine.
3. **Ileum :** is the lower (the third) component. It is the main parts of the small intestine. It Is about 5 m long and the major site of digestion and

absorption in the gut.

The Accessory Organs

What are accessory organs ?

Accessory organs are organs that add secretions and enzymes that break down food in to nutrients.

Accessory Organs includes :

- Salivary glands
- The pancreas
- The liver
- The gall bladder

The secretions of the pancreas, liver and gallbladder are regulated by hormones in response to food consumption.

The Liver : The liver is the largest internal organ in humans and it plays an important role in the digestion of fats and detoxifiction of blood.

- The liver produce bile.

Bile : is a digestive salt but not an enzyme

- It breaks down fats in to smaller molecules
- Bile temporarly stored in the gall bladder
- The breaking down of fats in to fat dropletes called emulsification.

$$\text{Fat} \xrightarrow{\text{Bile}} \text{Fat droplets (emulsification)}$$

- Bile neutralizes the acid food called chyme came from the stomach when the pyloric sphinctor opens.
- Bile provide alkaline (or basic) medium for the best function of pancreatic juices

The characterstic brown colour of feaces is the results of the colour of the bile

The Pancreas : - It is a tongue - like shaped gland which lies beneath the stomach.

- It secreates a juice called pancreatic juices, which consistes of enzymes called trypsin, pancreatic amylase and lipase.
- Pancreatic juices secreated in to the duodenum
- Digestion of food by the action of pancreatic juices in the duodenum are:

$$\text{Starch} \xrightarrow{\text{Pancreatic amylase}} \text{Maltose}$$

$$\text{Peptones and Proteoses} \xrightarrow{\text{Trypsin}} \text{Peptides.}$$

$$\text{Fat dropletes} \xrightarrow{\text{Lipase}} \text{Fatty acids + glycerol}$$

Trypsin is a protein digesting enzyme called trypsinogen is released from the panceas. Once the trypsinogen reaches the small intestine an enzyme called enterokinase converts the in active trypsinogen in to active trypsin.

Ileum Region

Ileum region is the lower, the longest and narrower parts of the small intestine.

The ileum region has both digestive and absorptive role.

Digestion of food completed and absorption of food takes place in the ileum region.

☒ The ileum region contain intestinal glands which secretes juices called intestional juices.

☒ The intestinal juices consistes of enzymes that brings about the end products of digestion.

☒ Intestinal enzymes are :

- Sucrase enzyme
- Maltase enzyme
- Lactase enzyme
- Lipase enzyme
- Erepsin enzyme

$$\text{Maltose} \xrightarrow{\text{Maltase}} \text{glucose + glucose}$$

$$\text{Sucrose} \xrightarrow{\text{Sucrase}} \text{glucose + fructose.}$$

$$\text{Lactose} \xrightarrow{\text{Lactkose}} \text{glucose + galactose}$$

$$\text{Fat droplet} \xrightarrow{\text{Lipase}} \text{Fatty acid + glycerol}$$

$$\text{Peptides} \xrightarrow{\text{Erepsin}} \text{amino acids}$$

Digestion of food completed in the ileum region. Digestive end products of food are :

- Glucose
- Amino acids
- Fatty acids and glycerol

Table 11 . 1 Summary of Enzymatic actions in the Human Digestive System.

Parts of the gut	Glands	Secretions	PH	Enzymes	Reaction
Mouth	Salivary glands	Saliva	7	Salivary amylase (ptyalin)	$\text{Starch} + H_2o \xrightarrow{\text{Ptyalin}} \text{Maltose}$
Stomach	Gastric glands	Gastric Juices	2	Pepsin & Renin	$\text{Protein} \xrightarrow{\text{Pepsin}} \text{Peptones}$ Coagulates milk protein
Duodenum	Pancreas	Pancreatic Juices	8	Amylase Trypsin Lipase	$\text{Starch} + H_2o \xrightarrow{\text{Amylase}} \text{Maltose}$ $\text{Peptones} \xrightarrow{\text{Trypsin}} \text{Peptides}$ $\text{Fats} \xrightarrow{\text{Lipase}} \text{Fatty}$ acide and glycerol
Duodenum	Liver	Bile	8	Bile salt	$\text{Fats} \xrightarrow{\text{Bile}} \text{Fat}$ droplet
Ileum	Intestinal glands	Intestinal juices	8.5	Maltase Sucrase Lactase Lipase Erepsin	$\text{Maltose} \xrightarrow{\text{Maltase}}$ glucose+glucose $\text{Sucrose} \xrightarrow{\text{Sucrase}}$ glucose and Fructose $\text{Lactose} \xrightarrow{\text{Lactase}}$ glucose and galactose $\text{Fat} \xrightarrow{\text{Lipase}} \text{Fatty}$ acid and glycerol $\text{Peptides} \xrightarrow{\text{Erepsin}} \text{amino acid}$

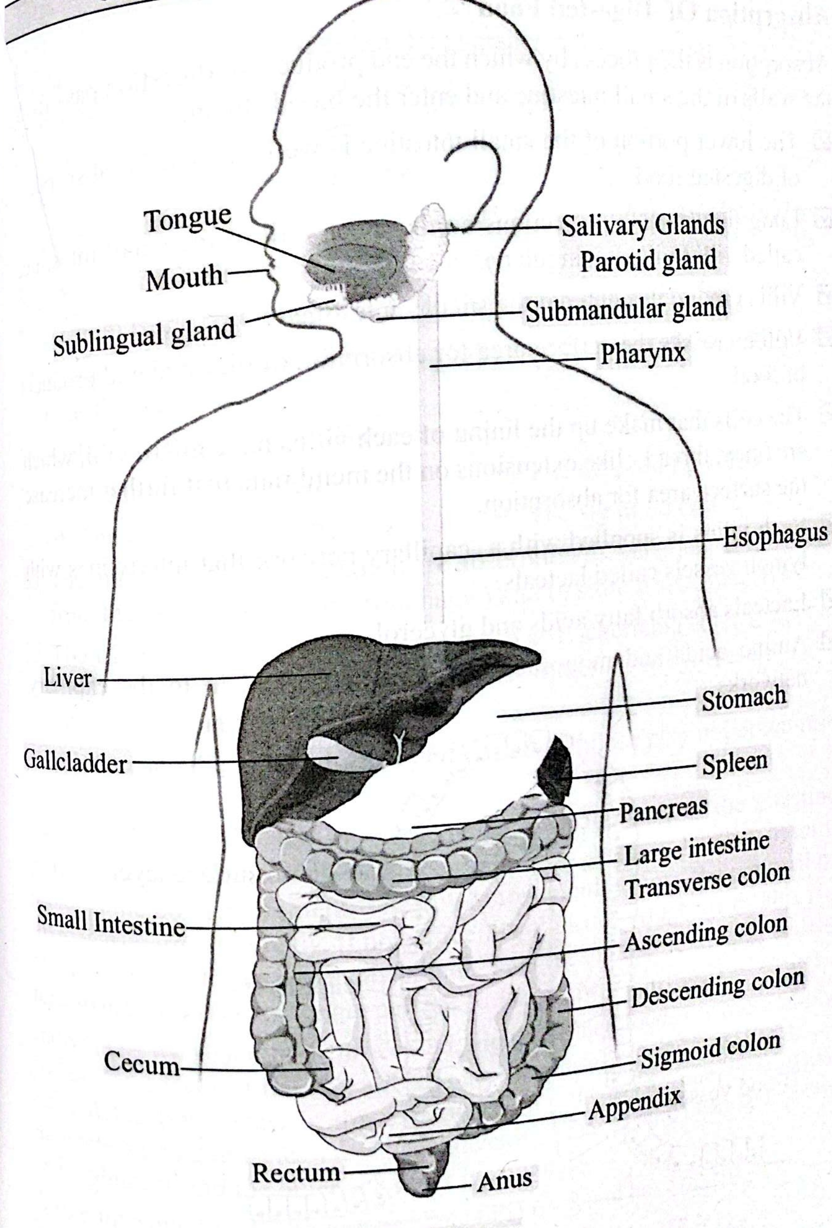

Tongue
Mouth
Sublingual gland
Salivary Glands
Parotid gland
Submandular gland
Pharynx
Esophagus
Liver
Gallcladder
Stomach
Spleen
Pancreas
Large intestine
Transverse colon
Small Intestine
Ascending colon
Descending colon
Cecum
Sigmoid colon
Appendix
Rectum
Anus

Fig 11.4 The human Digestive System

Absorption Of Digested Food

Absorption is the process by which the end products of digestion pass from the walls of the small intestine and enter the blood stream.

☑ The lower portion of the small intestine is well adapted for absorption of digested food

☑ Long finger - like projections on the inner wall of the small intestine, called villi (villus - singular).

☑ Villi is found through out the small - intestine.

☑ Villi increases the surface area for absorption of digested end products of food.

☑ The cells that make up the lining of each villus have micro villi, which are tiney, thread - like extensions on the membrane that further increase the surface area for absorption.

☑ Each villus is supplied with a capillary network that intertwines with lymph vessels called lacteals.

☑ Lacteals absorb fatty acids and glycerol.

☑ Amino acids and monosaccharides are absorbed in to the capillary networks.

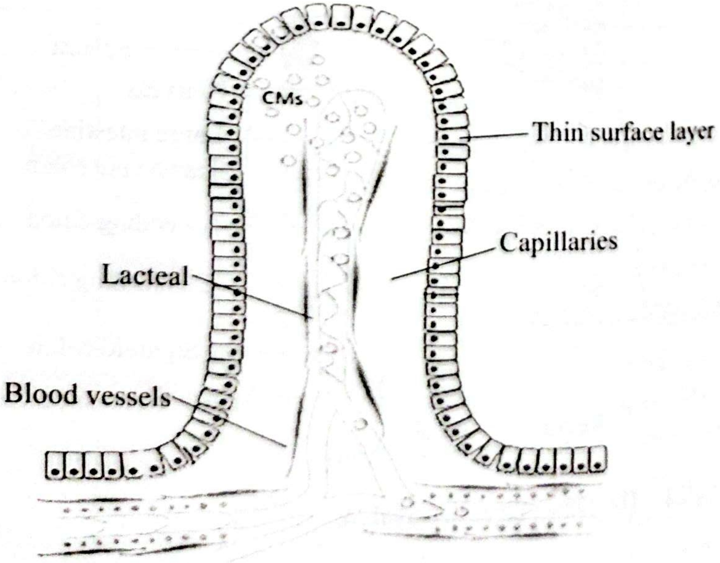


Fig 11.5 Anatomy of villus with the lacteal

Large Intestine

The large intestine is called colon. It is smaller in length in human compared to the small intestine.

☑ Colon is larger in diameter.

☑ Colon has three parts : These are

- Caceum
- The colon
- The rectum

☑ The caceum joins the ileum to the colon.

☑ Caceum is the receiving pouch for the waste matter

☑ The colon is a home to many bacteria or intestinal flora that aid in the digestive process

The colon has four regions These are :

- The ascending colon
- The transverse colon
- The descending colon
- The sig moid colon.

☑ The main function of the colon are absorption of water and mineral salt from the undigested food (roughage) and to store waste materials.

☑ The large intestine houses bacteria, such as Escherichia coli (E - coli) which are essential for life and use waste materials to synthesise vitamine B and K.

Cellulose reach the large intestine undigested cellulose play important role - cellulose provide bulk.

As bulk built up in large intestine, receptor in the wall of the intestine provide information to the C N S (central nervous system), which in turn, prompts the bowl movement. The bowl movement ensures the removal of toxic waste, from the body. If no sufficeint cellulose (roughage or fibre) in the diet, have a fewer bowl movement. This means that toxin and wastes remain in this bodies for longer periods cancer of the colon is related to diets. Individuals who eat mostly processed, highly refined foods are more likely to develop cancer of the colon feaces are temporarly stored in the rectum, until defecation. Anus is the exit point for the waste materials. Two sphincters (ring muscles) regulates the exit of feaces ; the inner sphincter is involuntary and the outer sphincter is voluntary

Large intestine lined with mucus glands PH 6 - 8 and have no enzymes.

The Main Activities Carried out by large intestine are :

- The main functions of large intestine is the absorption of water and mineral salts .

- Mucus lubricates feaces
- Bacteria in large intestine synthesizes vitamine B and K.
- Feaces mainly have water, bacteria, lipids and dietary fiber cellulose, e t c that are egested out through the anus.

Conceptual Example

20. Where is the pyloric sphincter muscle is located in human digestive system ?

Explanation

The pyloric sphincter muscle is a ring muscle which is found in between the stomach and the small intestine (duodenum part). It is located at the lower end of the stomach.

☑ The following three questions shown below are on the bases of the different reactions that take place in the alimentary canal of human.

Reaction **Products**

1. Lipids $\xrightarrow{\text{Bile}}$ Fats dropletes
2. Protein + H_2o $\xrightarrow{\text{Pepsin}}$ Peptones and Proteoses
3. Starch + H_2o $\xrightarrow{\text{Amylase}}$ Maltoses
4. Peptides + H_2o $\xrightarrow{?}$ Amino acids
5. Fat dropletes $\xrightarrow{\text{Lipase}}$ Fatty acid + glycerol

21. Where does the reaction indicated by no 1 take place ?

Explanation

Lipids are changed in to fats droplетes by the action of bile in the duodenum region of the small intestine Fat droplетes are provided to be digested by lipase, a fat digesting enzyme.

22. What is the name of the enzyme that causes the digestion indicated by no 4

Explanation

Erepsine or peptidase is an intestinal enzyme called protease which convert peptide of an intermediate digestion of protein in to an end product of protein digestion called amino acids in the ileum region of the small intestine.

23. What is the product of the digestion reaction process indicated by no 5 ?

Explanation

Fatty acids and glycerol are digestive end products of fats (Fats droplетes) Lipids are emulsified by bile in to tiny - fats droplетes. It is provided to be digested by a Lipid - digesting enzymes called lipase

24. Sketch the digestion routes of protein from it's beginning to it's end ?

Explanation

- Protein digestion begins in the stomach.
- Stomach is the principal organ for protein digestion

Protein $\xrightarrow[\text{(In the Stomach)}]{\text{Pepsin}}$ Peptones and Proteose $\xrightarrow[\text{(In the duodenum)}]{\text{Trypsin}}$

Peptides $\xrightarrow[\text{(In the Ileum)}]{\text{Erepsin}}$ Amino acids (digestive end product)

Pepsin = is secreted from stomach lining (stomach wall) as in the form of pepsinogen (inactive).

Pepsinogen + dilute hydrochloric acid = pepsin (active)

Trypsin = is a pancreatic juice which is sereted from the pancreas as in the form of Trypsinogen (inactive) .

Trypsinogen + Bile = Trypsin (active)

Erepsin is an intestinal juices secreted from the intestinal glands. It converts peptides of protein into it's digestive end products, amino acids.

25. Explain the meaning of peristalsis ?

Explanation

Peristalsis - is the movement of the food along the get its muscellar contraction and relaxation

26. List out the contents of the following secretions of the human gut

- Gastric juice
- Pancreatic juice
- Intestinal juice

Explanation

Solution	Secreted by	Secretions
Gastric juice	Gastric glands	H C l, Mucus, Pepsin, rennin.
Pancreatic juice	Pancreas	Lipase, trypsin, amylase
Intestinal juice	Intestinal gland	Lipase, Sucrase, Maltase, lactase , erepsin.

27. What is the importance of rouphage in the human digestive system ?

Explanation

Rau phage is undigested remains of food that passes down from small intestine to the large intestine. It is used to facilitate the digestive process and avoid constipation since it contains excess water.

28. Describe the structures which are not parts of the gut but play role in assisting the human digestive system.

Explanation

Liver and pancreas are not parts of the gut or not part of the alimentary canal, but though they play role in digestion.

The liver secretes the bile, while the pancreas produces pancreatic juice which contains enzymes.

29. Trace the path way of the human gut .

Explanation

Mouth → Esophagus → Stomach → Small Intestine → Large Intestine → Anus.

30. List out at lest three examples for

- Protease enzymes

- Carbohydrate enzymes

Explanation

- Protease enzymes are protein digesting enzymes. Examples : pepsin, rennin, trypsin, erepsin
- Carbohydrase enzymes are enzymes that digest carbohydrates Examples : Amylase, sureease, lactase, moutase.

31. Describe the functions of the following parts of the large intestine

- Colon
- Rectum

Explanation

Colon reabsorbs water from the rau phage which helps to:

- Facilitate the digestive process.
- Avoid constipation
- Rectum is parts of the large intestine that temporarly stores undigested foods in the form of feaces until defecated through the anus.

32. Mention the disorder in digestive system that is caused by lack of fibres food and lack of enough water.

Explanation

The disorder in digestive system is known as **constipation.**

33. Which enzymes secreted by the pancreas promote digestion ?

Explanation

Pancreatic secretion that promote digestion are called pancreatic juices. These are :

Trypsin = digeste peptoses and proteoses of an intermediate digested protein in to peptides.

Lipase : The enzyme that digeste lipids in to fatty acids and glycerol, which is fat (lipid) digestive end products.

Pancreatic amylase : digest any remaining starch that is not digested in the mouth in to maltose

34. Why are carbohydrates not digested in the stomach ?

Explanation

Stomach wall secrete protein digesting enzyme called pepsin. There is no carbohydrate digesting enzymes are secreted in the stomach.

35. Explain the chemicals and processes involved in protein digestion.

Explanation

The stomach lining secrete gastric juices containing protein - digesting enzyme called pepsin.

Protein $\xrightarrow{\text{Pepsin}}$ Peptoses and proteoses.

Rennin especially in children solidifies milk - protein called casein, to be digested by pepsin.

36. List the lipid digesting enzymes secreted from the pancreas .Do at these enzymes allow for a complete break down of lipids ?

Explanation

Lipase is a lipid - digesting enzyme, that convert lipids in to digestive end products called fatty acids and glycerol.

37. How is the duodenum protected against stomach acid ?

Why does pepsin remain inactive in the deudenum ?

Explanation

Bile is secreted from the liver and emptyed in to the duodenum through the bile - duct .

Bile is a digestive salt that neutralize the acid that comes from the stomach which provide alkaline medium for the proper functioning of the pancreatic juices pepsin function best at acidic medium provided by the dilute hydrochloric acid in the stomach. Thus, pepsin remain in active in the alkaline medium provided by bile in the duodenum.

38. What are the compositions of gastric juices ?

Explanation

Gastric juices includes:

- Mucus
- Dilute hydrochloric acid (dil . H C 1)
- Pepsinogens and other substances.

39. What do we call the partially digested food in the stomach ?

Explanation

It is called chyme

40. What are accessory organs ?

Explanation

Accessory organs include :

- The salivary glands
- The pancreas
- The liver
- The gall bladder. These accessory organs support or facilitate the process of digestion.

41. What is the importance of liver ?

Explanation

The liver produce bile. The function of bile include : emulsification or break down fat globules. The liver also stores glycogen and vitamines A, B 12 and D and the liver detoxify many harmful substances in the body.

Illustrative Examples with explanatory note

42. Enzymes are made up of

A. Fats C. Proteins
B. Carbohydrates D. Mineral salts

Explanation

Enzymes are biological catalysts which are used to regulate or speed up the chemical reactions in the body They are made up of complex proteins.

Answer : C

43. In mamals which of the following starts being digested in the stomach and its digestion finished in the small intestine ?

A. Starch
B. Fat
C. Sugar
D. Protein

Explanation

Stomach is the principal organ for protein digestion protein digestion starts in the stomach by the action of enzyme called pepsin .

Protein $+H_2o \xrightarrow{\text{Pepsin}}$ Peptoses and ends in the small intesine by the action of erepsin peptides $\xrightarrow{\text{erepsin}}$ amino acids

Answer : D

44. Bile salt is used to break down fats into small easily digested fat droplets. This process is called ___

A. Absorption
B. Emulsification
C. Digestion
D. Excretion

Explanation

Bile is a digestive salt which is secreted by the liver. Its stored in gall bladder temporarly It works in digestive activity which takes place in the duodenum. It helps for :

- ➡ Neutralizing the acidity of chyme
- ➡ Emulsification of fats.

Fat $\xrightarrow{\text{bile}}$ Fat droplets (Emulsification)

Answer : B

45. Which of the following enzyme act on proteins in the stomach ?

A. Renin
B. Peptidase
C. Lactose
D. Lipase

Explanation

Renin is an enzyme that works for protein digestion in children . It helps to solidify milk protein in children caesin. Then caesin is digested by protein - digesting enzyme called pepsin.

Answer : A

46. Which of the following organic compounds undergo partial chemical digestion in human mouth ?

A. Carbohydrates
B. Fat
C. Proteins
D. Minerals

Explanation

Chemical digestion of carbohydrates starts in the mouth by the action of an enzyme called salivary amylase or ptyalin.

Starch $\xrightarrow{\text{amylase}}$ maltose

Answer : A

47. Which of the following portions of a food is usable and digestible ?

A. Rouphage
B. Bulk
C. Fiber
D. Nutrient

Explanation

Nutrients are usable and digestible portions of the food that are absorbed in to the blood stream in the small instesine . while, rouphage, fiber or bulk are undigested remains of the food.

Answer : D

48. Which of the following are produced as a result of the mechanical digestion of a piece of meat ?

A. Amino acids
B. Peptides
C. Small meat
D. Peptons

Explanation

Mechanical digestion - is a kind of digestion which involves break down of large food particles into smaller pieces without bringing any kind of chemical change.

Answer : C

49. Which of the following protein digesting enzymes is found in the stomach ?

A. Pepsin
B. Erepsin
C. Rickets
D. Marasmus

Explanation

Pepsin and rennin are protease enzymes which are found in the stomach.

Answer : A

50. Which of the following digenstive process is affected if the gall bladder

CS CamScanner

is surgically removed ?

A. Digestion of lipids
B. Digestion of carbohydrates
C. Digestion of proteins
D. Digestion of vitamins

Explanation

Gall bladder is a storage site of bile which is used for emulsification of fat.

Answer : A

51. Saliva contains an enzyme that begins the digestion of .

A. Protein
B. Disaccharide
C. Starch
D. Peptides

Explanation

Saliva consists of an enzyme ptyalin that change starch into maltose.

Starch $\xrightarrow{\text{Ptyalin}}$ maltose it is chemical digestion in the mouth

Answer : C

52. Which statment describes all enzyme ?

A. They control the transport of materials
B. They provide energy for chemical reactions
C. They afftect the rate of chemical reactions
D. They absorb oxygen from the environment

Explanation

Enzymes affect the rate of chemical reactions by speeding it.

Answer : C

53. In a food test if an unknown food decolorizes D C P IP the food contains.

A. Vitamin
B. Protein
C. Starch
D. Mineral

Explanation

D C P I P colorizes the food sample if it contains vitamin c

Answer : C

54. Which of the following is the main function of the large intestine ?

A. Absorption of sugars
B. Absorption of fatty acids
C. Absorption of amino acids
D. Absorption of water

Explanation

Large intestine has part which is known as colon that is used to absorb water from fiber or rouphage.

Answer : D

55. Which of the following is not an enzyme althouth it plays role in digestion ?

A. Lipase
B. Bile
C. Renin
D. Amylase

Explanation

Bile is a digestive salt which is produced by the liver to emulsity fat in to fat droplets.

Answer : B

56. Which of the following is part of the small intestine ?

A. Ileum
B. Rectum
C. Colon
D. Anus

Explanation

Small intestive has three major parts. These are duodenum, jejnum and ileum has both digestive and absorption role.

Answer : A

57. Which of the following end product of digestion pass in to lacteals during absorption of food ?

A. Vitamin
B. Fatty acids
C. Glucose
D. Amino acids

Explanation

Absorption of glucose, amino acids, and vitamins take place through capillaries in villi, which are finger like projections in the ileum. Fatty acids and glycerol are too large to be absorbed by villi, thus they are absorbed in to lacteals.

Answer : B

58. Under which of the following conditions does the enzyme ptyline works best ?

A. PH 7 and 30^0 c
B. PH 7 and 37^0 c
C. PH 2 and 300 c
D. PH 5 and 37^0c

Explanation

Enzymes are sensitive to PH and temperature, thus ptylin is an enzyme that works best at P H 7 and 37^0 c, which is human body temperature.

Answer : B

59. Which of the following food items is correctly matched with its digestive enzyme and producet of digestion ?

A. Peptones $\xrightarrow{\text{trypsin}}$ Peptidos

B. Proteins $\xrightarrow{\text{lipase}}$ amino acid

C. Fats dropleites $\xrightarrow{\text{Bile}}$ Faty acid and glycerol

D. Starch $\xrightarrow{\text{Pepsin}}$ Maltose

Explanation

The correct match of food items with their causes of reactions and products are :

Fat dropletes $\xrightarrow{\text{Lipase}}$ Fatty acid and glycerol

Starch + H_2o $\xrightarrow{\text{Ptyalin}}$ Maltose

Peptones and Proteose $\xrightarrow{\text{Trypsin}}$ peptides

Peptides $\xrightarrow{\text{crepsin}}$ amino acids

Answer : A

Supplementary Exercises

Part I Multiple choice Item # 1

60. Of the following groups of nutrients which one is required by the body in a very small amount ?

A. Carbohydrate C. Proteins
B. Vitamins D. Lipid

61. Among the following types of carbohydrates which one is a complex sugar ?

A. Fructose B. Galactose C. Cellulose D. Maltose

62. The sugar which is found in milk is called

A. Sucrose B. Lactose C. Mautose D. Galactose

63. All of the following are correct about carbohydrat except.

A. It a macronutrient
B. It 's the main source of energy for the body
C. It's the storage form of energy in the body
D. It helps to build and repair the tissue

64. Which of the following is corrects

A. Glucose + Fructose → Lactose
B. Galactose + Glucose → Maltose
C. Glucose + Fructose → Sucrose
D. Glucose + Glucose → Lactose

65. An element which is used in making proteins but not found in carbo hydrate and lipids is

A. Carbon B. Oxygen C. Nitrogen D. Hydrogen

66. The process by which soluble food passes through the walls of the small intestine in to the blood vessels is :

A. Egestion C. Digestion
B. Ingestion D. Absorption

67. One of the following statements is correct

A. All enzymes work best in acidic P H
B. Most human enzymes work best at body tempreature.
C. Enzymes are proteins that undago physical change.
D. They are destroyed in the process of the reaction

68. Enzymes that perform their activities out side the cell are called.

A. Respiratory enzymes C. Extra cellular enzymes
B. Intracellular enzymes D. Biological enzymes

69. Human digestive enzyme that optimally function at PH around neutrality is

A. Pepsin B. Renin C. Ptyalin D. Typsin

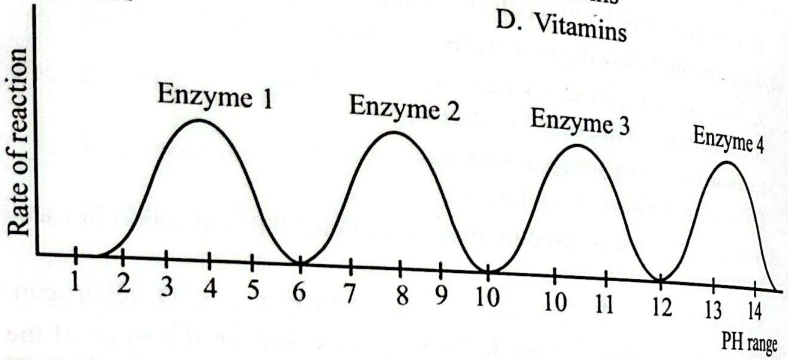
70. A person whose gallbladder is surgically removed is be careful to restrict his dietary in take of.

A. Starch
B. Protein
C. Water
D. Fat

71. Which pair is not correctly matched ?
A. Glucose - Monosaccharide
B. Galactose - Disaceharide
C. Cellulose - Polysaceharide
D. Sucrose - disaccharide

Answer : B

72. Which nutrient does the human stomach principally digest ?
A. Carbohydrates
B. Fats
C. Proteins
D. Vitamins



73. In the above figure which Enzymes is likely to be most active in the human stomach ?
A. Enzyme 1
B. Enzyme 2
C. Enzyme 3
D. Enzyme 4

74. Rickets is caused by the lack of
A. Iron and Calcium
B. Iron and Phosphorus
C. Calcium and Phosphorous
D. Iodine and Phosphorus

75. Pepsin is a digestive enzyme that acts on
A. Proteins
B. Carbohydrates
C. Fats
D. Vitamins

76. The Pancreatic juice does not contain one of the following enzymes.
A. Trypsin
B. Lipase
C. Pancreatic amzlase
D. Lactose

77. The enzyme ptyalin functions best at a
A. Slightly acidic medium
B. Slight basic medium
C. Neutral medium
D. Strongly acidic medium

78. Which one of the following is not true about proteins ?

A. They are made up of amino acids
B. Buriet reagent turns proteins blue
C. They form the main tissues of organisms
D. Some proteins act as catalysts

79. Chemical digestion begins in the
A. Mouth
B. Esophagus
C. Stomach
D. Small intestine

80. The reason why there are so many different kinds of enzymes in a cell is that
A. An enzyme can be used over and over again
B. Enzymes are very specific
C. The activity of enzymes can be affected by high temperature
D. The activity of enzymes can be affect by low PH,

81. If equal amounts of the following substances are metabolized by the body, the largest amount of energy is released from
A. Carbohydrate
B. Protein
C. Fat
D. Vitamin

82. Choose in correctly matched - enzyme with its secreting gland
A. Ptyalin - Salivary glands
B. Lipase - intestinal glands
C. Pepsin - gastric glands
D. Erepsin - intestinal glands

83. Which of the following alternatives consists of the end products of digestion
A. Sugar, proteins, fat and glycerol
B. Amino acids, glucose, fatty acid and glycerol
C. Polysaccharides, proteins, fats and oils
D. Glucose, triglycerides, maltose, glycoprotein

84. Which of the following can not be directly absorbed into the villi which are the walls of the small intestine ?
A. Proteins
B. Fatty acids
C. Glucose
D. Amino acids

85. Which of the following reactions take place when a muscle is contracting ?
A. A OP + Pnosphate + Energy → ATP
B. ATP → ADP + Phosphate + Energy

C. ATP + Phosphate → ATP + Energy

D. ATP + Phosphate → ADP + Energy

86. One of the following is not the activities carried out in the large intestine

A. Absorption of water

B. Absorption of minerals

C. Absorption of digestive end products of food

D. Egest out fibre cellulose

Answer Key For

Supplementary Exercise

60. B	64. C	68. C	72. C	76. D	80. B	84. B
61. C	65. C	69. C	73. A	77. A	81. C	85. B
62. B	66. D	70. D	74. C	78. B	82. B	86. C
63. D	67. B	71. B	75. A	79. A	83. B	

11.2 The Circulatory and Lymphatic System

The Circulatory System

The circulatory system is system of blood vessels transporting blood around the body via the heart.

☑ It is a means by which blood moves through out the body.

☑ The transport system is required to supply the needs of body cells and remove the material they produce.

☑ The three main elements of the blood circulation system are:

i. Blood vessels (the pipes)

ii. The heart (the pump)

iii. The blood (the medium)

All mammals have a similar circulatory system.

☑ The circulatory system has major functions.

The major functions of the circulatory system are the following

- It carries nutrients to cells.
- It removes wastes away from cells.
- It carries chemical messangers from cells in one part of the body to distant target tissues called hormones.

- It distributes heat through out the body and along with the kidneys.
- It maintains levels is of body fluids
- It provides oxygen for the cellular respiration
- It transports of immune cells through out the body to defend against invading organisms.

The Blood Vessels

The blood vessels are the path way or the pipe through which transport takes place.

There are : Artery, Vein and Capillaries, which are adapted to carry out particular functions with in the body.

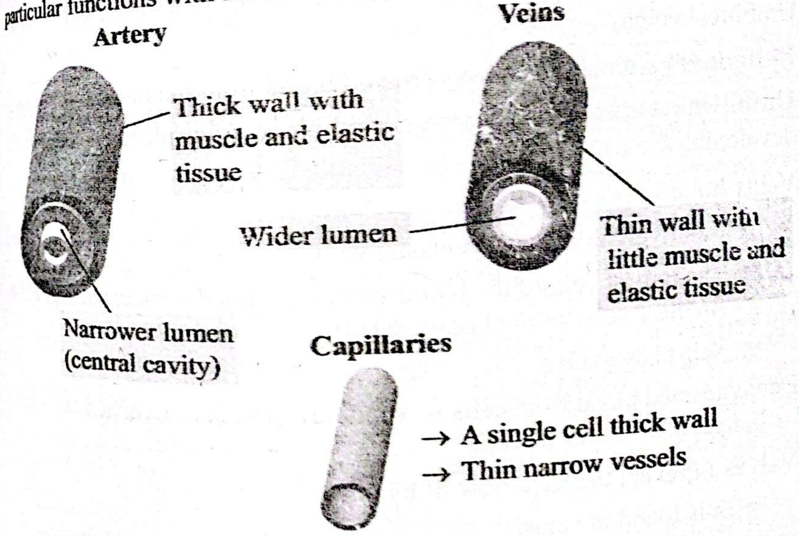

Artery
Veins
Thick wall with muscle and elastic tissue
Wider lumen
Thin wall with little muscle and elastic tissue
Narrower lumen (central cavity)
Capillaries
→ A single cell thick wall
→ Thin narrow vessels

Fig 11.6 Blood vessels for different functions

i. **Arteries :** Artery is a blood vessels that is used to carry blood away from the heart.

- Arteries carries oxygenated blood except the pulmonary artery and the umblical artery.

Pulmonary artery :- carry deoxygenated blood away from the heart to the lung

Umblical artery :- carry deoxygenated blood away from a foetus to placeta.

Arteries have :

- Thick and elastic wall
- The largest artery is called aorta, to resist the pumping forces from the left ventricles.
- The smallest arteries are called arterioles.
- Contain no valves

LV → Aorta → artery → Arterioles → capillaries to cells

ii. Veins

- Veins return blood back to the heart.
- Veins carry deoxygenated blood except the pulmonary veins and the

Umbilical veins.

Pulmonary Veins : return oxygenated blood from the lungs to the heart.

Umbilican Veins : carries oxygenated blood from placenta back to the developing foetus.

Veins have

- Relatively thin and less elastic wall
- The largest vein of the blood vessels is called vena cava, while the smallest veins of the body are called venuoles.
- Veins have valve

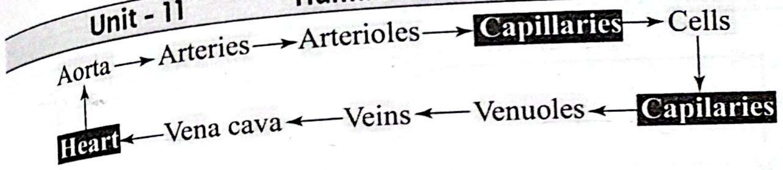
Deoxygenated blood from cells → venuoles → veins → venacava → heart → lungs.

Valves : Prevent the back flow of blood

- It is found in veins

iii. Capillaries

- Capillaries are a single cell thick wall
- Thin narrow blood vessels
- Capillaries are narrow, thin - walled blood vessels
- The capillaries help to connect arteries with cells and cells with veins - capillaries carries oxygenated blood to cells and deoxygenated blood from cells.
- Capillaries have no valves



The path root of blood flows

Table 11 . 2 The main blood vesseis (Artery and veins) of the body and their functions.

Blood Vessels	Supplies Blood to
1. Aorta	☑ Supplies oxygenated blood from the L- V to the body
2. Renal artery	☑ Supplies oxygenated blood to the kidney
3. Iliac artery	☑ Supplies oxygenated blood to the lower parts of the body and the legs.
4. Mezentric artery	☑ Supplies oxygenated blood to the gut.
5. Carotid artery	☑ Supplies oxygenated blood to the head.
6. Hepatic artery	☑ Supplies oxygenated blood to the liver.
7. Pulmonary artery	☑ Carries deoxygenated blood to the lungs
8. Pulmonary vein	☑ Carries deoxygenated blood to the left auricle (heart)
9. Jugular vein	☑ Carries deoxygenated blood from the head.
10. Vena Cava	☑ The largest vein of the body which carries deoxygenated blood from the body to the R . A
11. Renal Vein	☑ Carries deoxygenated blood from the kidney
12. Iliac vein	☑ Carries deoxygenated blood from the legs and the lower parts of the body.

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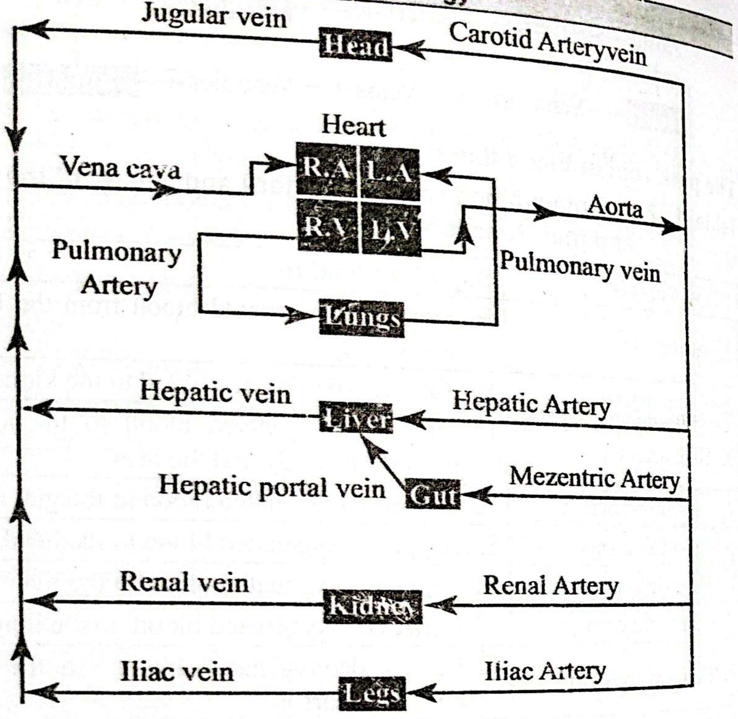

Jugular vein
Head
Carotid Arteryvein
Heart
R.A
L.A
R.V
L.V
Vena cava
Aorta
Pulmonary Artery
Pulmonary vein
Lungs
Hepatic vein
Liver
Hepatic Artery
Hepatic portal vein
Gut
Mezentric Artery
Renal vein
Kidney
Renal Artery
Iliac vein
Legs
Iliac Artery

Fig 11.7 The Human Circulatory system

The Heart

The heart is a muscular organ that pumps blood to circulate through out the body.

The heat well consistes of three : These are

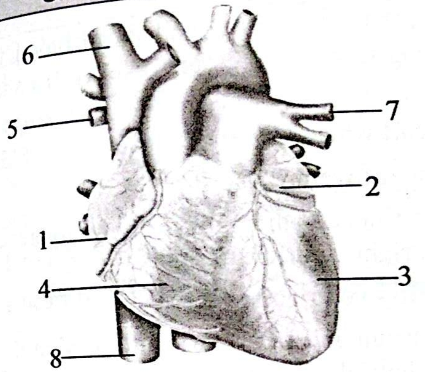
➥ Endocardium ➥ Myocardium ➥ Epicardium

The endocardium : is the thin membrane that lines the interior of the heart.

The epicardium : is the thin layers on the surface of the heart in which the coronary arteries lie.

A thin membrane sac the heart sits in , which surround and separates the heart from the other structures in the chest is called pericardium.

Pericardium allows them to move easily over each other They help prevent the heart from over distending with blood.



Description

1__________

2__________

3__________

4__________

5__________

Fig 11.8 The Heart Anatomy

The human heart is divided in to four chambers. These are :

☑ The two upper chambers are the right and left atria (R.A and L.A)

➥ The right ventricle (R . V)

➥ The left Ventricle (L . V)

☑ The R .A , L. A, R . V, and the L .V are the four heart chambers of human circulatory system.

☑ The heart consistes of two parallel pumps in to right and left sides separated by a wall called septum.

☑ The right side of the heart (R . A and R . V) contain deoxygenated blood and the left side of the heart (L. A and L .V contain oxygenated blood

☑ The Atrium (auricles) are recieves blood. The R . A recieves blood from the body through the largest vein called vena cava. The L. A recieves blood from the lungs through the pulmonary vein.

☑ Atria are the two thin - walled of the heart chambers.

☑ The ventricles are pumping blood. The R. V pump deoxygenated blood to lungs through the pulmonary artery.

☑ The L .V pump blood to the body through aorta ventricles are thicker than auricles (atrium).

☑ The Left ventricle (L .V) is the thickest, muscular and elastic wall in the cardio - vascular system of the heart Because it pumps blood at a distant to the body.

☑ Aorta is the thickest, muscular and elastic wall of all blood vessels because to resist the pumping forces or pressure exerted from the left ventricle.

Valves : are structures in the heart which prevent the back flow of blood :

i. Tri - cuspid valve (Right atrioventricular R A V)

- Valve between the right atrium and the right ventricles to prevent the back flow of blood from right ventricle to right atrium.

ii. Bi - cuspid valve (Left atrio - ventricular - L A V)

- Valve between the left atrium and left ventricle to prevent the back flow of blood from left ventricle to left atrium.

Semi - lunar valves

i. Valve that separate the right ventricle from the pulmonary artery. It prevents the back flow of blood from the pulmonary artery to the right ventricle and

ii. Valve that separate the left ventricle from the aorta. It prevents the back flow of blood from the aorta to the left ventricle.

How the Heart Works

☑ The heart works as a unit , with both sides contracting at the same time.

☑ The two auricles (R .A and L .A) contract together and the two ventricles (R . V and L . V contract together.

☑ The regular contraction and relaxation of the heart muscle continue through out life .

☑ This pumping blood through out life is called live pump.

☑ The contraction of the heart is called **Systolic** first the atria (R .A and L. A) contract together, followed by the contraction of the ventricles (R . V and L .V)

☑ The systole forces blood out of the heart to the lungs and general body circulation between contractions the heart relaxes and fills with blood. This relation stage is called diastole.

☑ The systole and diastole together make up a single heart beat called cardiac cycle.

The Cardiac cycle is made up of the following sequence of events

1. Blood enters the right atrium from the body and the left atrium from the lungs. The atria fill and then the atrio ventricular values (AV V) open under pressure so allowing the ventricles to fill as well This is **diastole.**

2. The two atria (R . A and L . A) contract together, forcing more blood in to the ventricle (R . V and L . V), which in turn both (the R .V and L . V) contract the same time. During this **Systole** pulmonary artery (from the R . V) and the aorta (from the L . V)

The Heart Beat

☑ The heart beat is the beating of the heart produces sound known as the heart beat .

☑ An instrument that is used to listen the beating of the heart rate is called Stetoscope.

☑ The sounds of the heart beat are made not by the contracting of the heart muscle, but by blood hitting the heart valves. The two sound of a heart beat are described as "lub - dub".

☑ The average heart beat rate of an adult human is 72 times per minute. However, the beating of the heart can be affected by factors such as exercise, age, emotions, drugs, etc.

☑ The Lu b ; or rest heart sound is the sound created by the closing of the atrioventricular valve as the ventricle contract.

☑ The second heart sound, "Dub" is the sound of the closing of the semilunar values during ventricular diastole (as the ventricles relax).

☑ The heart muscle is made up of a special muscle called cardiac muscle.

☑ The contraction of the heart muscle is stimulated by specialized tissues called pace maker. The pace maker stimulates the heart to beat by itself They are located on the right side of the heart where the contraction spreads to other parts of the heart.

The Blood Pressure

The blood pressure is the pressure that is exerted blood on the wall of the arteries as a result of the contraction and relaxation of the muscle of the heart. These are systolic and diastolic pressure.

Systolic Pressure : is a pressure which is formed by the contraction of the muscles of the heart.

The normal blood pressure of human is

$$B.P = \frac{\text{Systolic Pressure}}{\text{Diastolic Pressure}} = \frac{120\ \text{mmHg}}{80\ \text{mm Hg}}$$

Sphygmomanometer : is an instrument that is used to measure the blood pressure

The Double Circulatory System

The human circulatory systems are called adouble circulation system. The double circulation has two separate circuits in which blood enter the heart twice per circuit : The pulmonary circulation and the systemic circulation.

i. **The Pulmonary Circulation** : is the circulation of blood between the heart and the lungs.
   - Blood Pumped from the heart to the lungs for oxygenation, then back to the heart again

The blood route is :

R .V → Pulmonary artery → Lungs →
L.A ← Pulmonary vein

ii. **The Systemic Circulation** : is circulation of blood between the heart and the body.
   - Blood pumped from the heart to the body cell and then back to the heart again.

The Blood route is :

L.V → Aorta → Body vana cava ← R.A

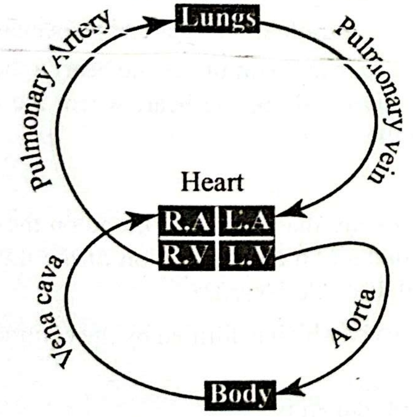


Fig 11.9 Double circulation

The systemic circulation divided in to two They are

- Coronary Circulation

- Portal Circulation

i. **The coronary circulation**
   - It carries blood to and from the cardiac muscle of the heart itself.

A. **Coronary artery :** carries food and oxygen (oxygenated blood) to the heart muscle is called coronary artery.

B. **Coronary Vein** : carries deoxygenated from blood the heart muscle is called coronary vein.

ii. **Portal Circulation**

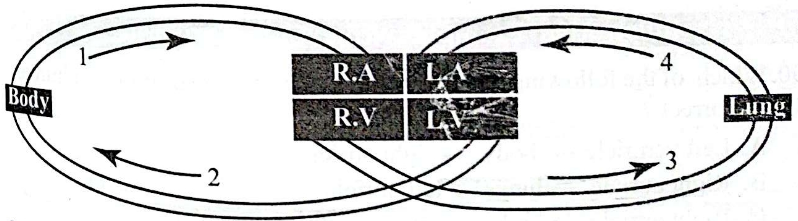
A. **Hepatic artery** : Supplies food and oxygen (oxygenated blood) to the liver.

B. **Hepatic Veins** : Carries deoxygenated blood from the liver

C. **Hepatic Portal Vein**
   - It carries digestive end products of food absorbed from the gut (small intestine) to the liver.

Conceptual Example

The next 3 questions are based on the following simplified diagram of the human circulatory system. The arrow indicates the directions of flows.



87. Mention the deoxygenated blood containing vessels ?

Explanation

Deoxygenated blood is a blood contain high concentration of carbondioxide . It has black red colour. The blood vessels indicated by number 1 and 3 carries deoxygenated blood.

Deoxygenated blood returns back to the R .A through the venacava from the body, indicated by number 1, from the R . V to the lungs through the pulmonary artery, indicated by no 3

88. Mention the oxygenated blood containing vessels in the diagram.

Explanation

Oxygenated blood is oxygen - rich blood, having bright - red colour oxygenated blood from the lungs enter the L . A of the heart through the pulmonary vein, indicated by number 4.

The L . V pump oxygenated blood to the body through aorta, indicated by number 2.

89. Indicate the blood routes of pulmonary and systemic circulation in the diagram.

Explanation

The pulmonary circulation : R . V → 3, Pulmonary artery → Lungs → 4, Pulmonary vein , → L . A

- Blood circulates from the heart to the lungs and back to the heart

The systemic circulation : L . V → Aorta → 2 → Body → 1 → Vena cava → R . A

- Blood circulates from the heart the heart to the body and back to the heart.

Illustrative Example with explanatory note

90. Which of the following path ways for the circulation of blood in human is correct ?

A. Left ventricle → body → right auricle
B. Right auricle → lungs → left auricle
C. Right auricle → body → left ventricle
D. Left ventricle → lung → left auricle

Explanation

The correct path way of blood flow is left atrium → left ventricle → body → right atrium → lung → right ventricle

Answer : A

91. Which of the following is correct about blood vessels ?

A. Capillaries are sites of exchange of materials
B. Arteries have values
C. Veins have twick walls
D. Arteries have thin walls

Explanation

Calpillaries are narrow, thin - walled vessels, where exchange of materials between the blood system and body cells takes place .

Answer : A

92. The arteries that carry blood to the wall of the heart are known as:

A. Coronary B. Carotid C. Hepatic D. Reneu

Explanation

Coronary artery carries blood to the heart

- Hepatic artery carries blood to the liver
- Carotid artery carries blood to the head and neck
- Renal artery carries blood to the kidney

Answer : A

93. Why are the muscles of wall of left side of the heart are thicker than the muscles walls on the right side ? Because they

A. Pump blood to relatively shorter distance
B. Protect the heart from external damage
C. Pump blood to relatively longer distance
D. Receive much of the digested food to build them.

Explanation

The right side of the heart pumps blood only to lung, however the left part of the heart pumps blood to the whole parts of the body, thus it has thicker wall.

Answer : C

94. The transfer of oxygen to the body cells takes place in the

A. Arterioles C. Capillaries
B. Artery D. Vanoles

Explanation

Capillaries are thin walled blood uessels where exchange of material between the body tissues and blood takes place.

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Answer : C

95. Which one of the following series represents the correct path of blood circulation ?
    A. Right atrium, right ventricle, lung, left atrium, left ventricle, body
    B. Left atrium, left ventricle, lung right atrium, right ventricle, body.
    C. Right atrium, lung, right ventricle, left atrium, body, left ventricle.
    D. Left atrium, left ventricle, right atrium, right ventricle, lungs, body.

Answer : A

96. Oxygenated blood leaves the human heart through the

A. Pulmonary vein	C. Vena cara
B. Pulmonary artery	D. Aorta

Explanation

Oxygenated blood leaves the left part of the heart through aorta and deoxygenated blood leaves the right side of the heart through pulmonary artery.

Answer : D

97. Which two chambers of the human heart conain oxygenated blood.
    A. Right auricle and left auricle
    B. Left auricle and right ventricle
    C. Left auricle and left ventricle
    D. Right auricle and right ventricle

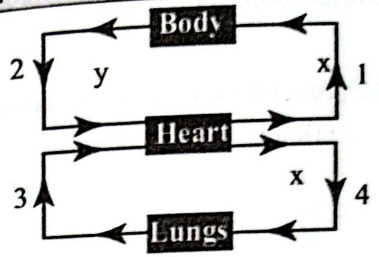
Explanation

The left part of the heart carvies oxygenated blood, while the right side of the heart carries deoxygenated blood.

Answer : C

98. Consider the following diagram showing the circulation system in the human body (ESSLCE, Hamle 2015E.C) In the diagram, the parts indicated by number 1,2,3 and 4 are respectively.
    A. Aorta, vena cave, pulmonary vein, pulmonary artery.
    B. Pulmouary artery, pulmonary vein, vena cave, aorta
    C. Pulmonary vein, aorta, vena cave pulmonary artery
    D. Vena cava, pulmonary artery, aorta, pulmorary vein

Answer: A



99. Arteries have thicker and more elastic of all the veins .This is due to the fact that.
    A. Veins receive blood under pressure
    B. Veins carry deoxygenated blood
    C. Arteries receive blood under pressure
    D. Arteiers carry more digested end products

Explanation

Arteries receive blood which is pumped out of the heart as a result of systolic pressure. Systolic pressure has high pressure than diastolic pressure.

Answer : C

100. The next 1 question is based on the following structure involved in pulmonary circulation (ESSLCE, 2014 E.C)

1. Right atrium	5. Lung
2. Pulmonary vein	6. Left atrium
3. Left ventricle	7. Right ventricle
4. Pulmonary artery	

The order of blood flow is

A. 1, 7, 2, 5, 4, 6, 3	C. 1, 6, 4, 5, 7, 3, 2
B. 1, 7, 4, 5, 2, 6, 3	D. 6, 3, 4, 5, 2, 1, 7

Answer : B

101. The chamber of the heart which pumps blood to all parts of the body.

A. Right auricle	C. Left auricle
B. Right ventricle	D. Left ventricle

Explanation

The Left ventricle pumps oxygenated blood to all parts of the body, while the right ventricle pumps deoxygenated blood to the lung.

Answer : D

102. Blood pressure is the pressure exerted by the blood on the wall of
   - A. Arteries
   - B. Auricles
   - C. Ventricle
   - D. Vein

Explanation

The blood pressure is created mainly as a result of contraction and relaxation of left ventricle

Answer : C

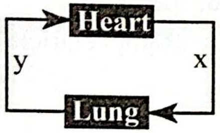
103. If one injects a blue dye into left ventricle, in which of the following parts of the heart will dye appear next ?
   - A. Right auricle
   - B. Left auricle
   - C. Pulmonary artery
   - D. Right auricle

Explanation

According to the path way of blood through the blood vessels and the heart, right auricle is the part where the dye appear next.

Answer : A

104. The next question is based on the following diagram about blood has carried given below.



Which of the following given alternative is correct about the diagram ?

- A. Path "*y*" carries oxygenated blood while path x carries deoxygenated blood
- B. The flow starts from the lungs and ends in the heart
- C. Path "*x*" carries oxygenated blood while path "*y*" carries deoxygenated blood.
- D. The diagram shows systematic blood circulation .

Explanation

Blood - that flows from lung to heart is oxygenated blood while blood that is carried from heart to lung is deoxygenated.

Answer : A

105. The structure that prevents the back flow of blood from right ventricle to the right atrium is known as .
   - A. Tricuspid valve
   - B. Semi lunar valve
   - C. Bicuspid valve
   - D. Septum

Explanation

The back flow of blood from right ventricle to right auricle is prevented by tricuspid valve, while the back flow of blood from left ventricle to left auricle is prevented by bicuspid valve .

Answer : A

106. The movement of blood from the heart to the lung and back to the heart is known as
   - A. Pulmonary circulation
   - B. Double circulation
   - C. Closed circulation
   - D. Open circulation

Explanation

Pulmonary circulation - is the flow of the blood between heart and lung.

Heart ⇌ Lung

Systematic circulation - is the flow of the blood between heart and parts of body,

Heart ⇌ Parts of the body

Answer : A

Conceptual Examples

107. Clearly differentiate between arteries and veins of the human body.

Explanation

Arteries	Veins
☑ Carry blood away from the heart ☑ Mostly carry oxygenated blood ☑ Have thick and elastic wall ☑ Have no valves	☑ Return blood back to the heart ☑ Mostly carry deoxygenated blood. ☑ Have thin and less elastic wall ☑ Have valves

108. What make pulmanary artery differe from the other arteries and what makes pulmonary vein different from the other veins ?

Explanation

Most arteries carries oxygenated blood and most veins carries deoxygenated blood .

However, pulmonary artery carry deoxygenated blood from the right ventricle to the lung to be oxygenated. Pulmonary veins carry oxygenated blood from the lungs to the heart (to the left auricle)

109. Write the names of blood vessels that carry blood to the kidney, head and gut respectively .

Explanation

☑ Renal artery : Carries oxygenated blood to the kidney

☑ Carotid artery : Supplies oxygenated blood to head and neck

☑ Mesenteric artery : Supplies oxygenated blood to the gut.

110. Clearly discuss the role of the following parts of the human heart.

A. Pericardium

B. Septum

C. Pace maker

Explanation

☑ Pericardium : is the membrane that surrounds the heart. Thus, it provides protection

☑ Septum : Prevents the mixing of oxygenated and deoxygenated blood

☑ Pacemaker : Stimulates the beating of the heart .

111. What is blood pressure ?

Explanation

Blood pressure is the pressure that is exerted by the muscular contraction (systolic pressure) and relation (diastolic pressure) of the heart.

112. Discuss the importance of

- ➥ Tricuspid valve
- ➥ Semi lunar valves
- ➥ Bicuspid valve

Explanation

☑ Tricuspid Valves - Prevents the back flow of the blood from the right ventricle to right atrium

☑ Bicuspid Valve - Prevents the back flow of the blood from the left ventricle to the right atrium.

☑ Semi Lunar Valves - Prevent the back flow of the blood from the pulmonary artery and aorta back in to the heart.

113. What is the difference between systolic pressure and diastolic pressure.

Explanation

Systolic Pressure : is the pressure which is exerted as a result of muscular contracts of the heart chambers.

Diastolic Pressure : is the pressure which is exerted as the result of muscular relaxation of the heart chambers.

114. What is Sphygmomanometer ?

Explanation

Sphygmomanometer : is an instrument which is used to measure the blood pressure of an individual.

115. Discuss the functions of the circulatory system ?

Explanation

The major functions of the circulatory system are

- ➥ It carries nutrients to cells

- It carries chemical messangers called hormones
- It maintains levels of body fluids
- It removes metabolic waste products from cells.
- It provides oxygen for cellular respiration
- It transports the immune system through out the body to defend pathogens

116. Why muscle of the heart on the left sides are thicker ?

Explanation

The cardiac muscle of the heart on the left side is called left ventricle. The left ventricle is the thickest heart muscle and elastic Because it pumps oxygenated blood to a distant part of the body . The L - V pump blood to the body through the aorta to different arteries and arterioles. The L - V have to be muscular, thick and elastic to pump blood at a distant to the body.

117. What is the function of the right ventricle (R .V) ?

Explanation

The function of the right ventricle is to pump deoxygenated blood to the lungs to be oxygenated through the pulmonary artery.

118. Mention the types of blood circulation in human ?

Explanation

There are two types of blood circulation. These are pulmonary circulation and systemic circulation . The pulmonary circulation is the circulation of blood from the heart to the lungs and back to the heart .

The systemic circulation is the types of circulation between the heart to the body and back to the heart .

119. State the function of the right atrium ?

Explanation

The function of the right atrium is to recieves deoxygenated blood collected from different parts of the body through veins and then by the venacava to the right atrium.

120. Elaborate the movement (circulation) of blood in your body ?

Explanation

Blood enters the heart through two large veins, the interior and superior vena cava, emptying oxygen poor (deoxygenated) blood from the body in to right atrium . The pulmonary veins empties oxygen rich blood (oxygenated blood) from the lungs in to the left atrium. Finally, oxygenated blood from the left ventricle is pumped out to the body and each cell.

121. Describe what alive pump mean ?

Explanation

The heart is a remarkable live pump. The heart pumps blood throught out the lift of the human being with out stoping.

122. List the human heart chambers ?

Explanation

The human heart consistes of four chambers.

2 atrium (right atrium and left atrium) and 2 ventricles (right ventricle and left ventricle)

The left and right side of the heart is separated by a wall called septum.

123. What types of valves are there between the heart chambers ?

Explanation

Valves prohibites the back flows of blood.

There are 4 types of valves in the heart .These are

- Bicuspid valve between the left atrium and the L . V
- Tricus pid valve between the right atrium and the R . V
- Semi lunar valve between the L . V and aorta.
- An other semi lunar valve between the R . V and the pulmonary artery.

The Blood

Blood is a fluid tissue that is used to carry nutrients, oxygen, metabolic waste products and other substances.

Blood is mostly liquid, with numerous cells and proteins suspended in it, making blood thicker than pure water. The average person has about 5 liters of blood.

The Blood Consistes of Solid and Liquid portion

i. **The Liquid Portion** of the blood is called blood plasma (Plasma).

☑ Plasma consistes of 55 % of the blood .

☑ It contains largely of water (90 %) and 10 % of dissolved substances, such as :

- Amino acids, glucose and other dissolved substances and digestive end products of food .
- Metabolic waste products such as urea, co$_2$ (5%) and mineral salts, e t c
- Antibodies, hormones, enzymes, e t c

☑ It also maintain relatively constant body temperature.

☑ Acting as a buffer to P H changes.

☑ The plasma also contain fibrinogen, a protein involved in blood - clotting.

ii. **The Solid portion** of the blood is made up of 45 % .

☑ The solid portion of the blood is called blood cells.

☑ The blood cells are Red blood cells (Erythrocytes), white blood cells (Leucocytes) and plateletes (Thrombocytes)

The Red Blood Cells (Erythrocytes) (R B C)

The R B C are biconcave disc- shaped, relatively large microscopic and non - nucleated cells.

☑ R B C normally make up 40 - 50 % of the total blood volume .

☑ R B C contain a red - iron protein called haemoglobin, is oxygen carrying and transporting protein molecule that make up 95 % of the red cell.

☑ People who are anemic have a deficiency of iron in red cells, and subsequently feel fatiqued due to a shortage of oxygen

☑ So it is important to eat enough iron in the diet.

☑ The red colour (pigment) of blood is primarly due to oxygenated red blood cells called oxyhaemoglobin. It has bright red coloured cell.

Haemoglobin + Oxygen = Oxyhaemoglobin.

☑ Carbondioxide is also carried in the blood, mainly as hydrogen carbonate ions.

Red Blood cells Adaptation

☑ Haemoglobin is largely responsible for efficient - oxygen transportation.

☑ The biconcave disc - shaped of R B C proved a large surface area to volume ratio for the diffusion of oxygen in to and out of the cell.

☑ Lack of a nuclevs in matured R B C means that the maximum amounts of space is available to pack in haemoglobin molecule to carry oxygen.

☑ Very thin cells surface membrane enable o$_2$ and co$_2$ can diffuse in and out rapidly.

☑ The red blood cells (erythrocytes) are manufactured in the red bone - marrow of short bones .

☑ R B C have alimited lite span of about 120 days.

Other Respiratory Pigments

Two respiratory pigments other than haemoglobin are found in human. These are :

- Fetal haemoglobin
- Myoglobin

i. **The Fetal haemoglobin :** The fetus in the uterus is dependent on the mother to supply if with oxygen.

- It has higher affinities from oxygen than does the haemoglobin of the mother. The difference is due to the number of amino acids chain.
- The fetal amino acids have three chains of amino acids while the mother (the adult) has produce only two chains . As a result fetal haemoglobin molecules attract, Or take up take and transport relatively more oxygen from the blood.

ii. **Myoglobin :** It is found mainly in the skeletal muscle .

- It is a single heamoglobin chain
- It is much higher affinity for oxygen than haemoglobin.

- It acts as oxygen store.

White Blood Cells (Leukocytes)

White blood cells, or Leukocytes (W B C), exist in variable numbers and types.

☑ W B C make up a very small part of blood's volume

☑ It normally exists only about 1 % in heal thy man

☑ W B C are not limited to blood, but occurs else where in the body as well. Such as :

- In the spleen
- In the lymph glands
- In the liver
- **In the bone marrow**

Where does W B C (Leukocytes) Manufacture ?

☑ W B C are manufactured mostly in the white bone marrow of long bones.

☑ Others lymphocytes produced in the lypmph glands of thymus gland (at the base of the neck) and in the spleen.

☑ W B C are irregular shaped, larger than erythrocytes and have nucleated and are colourless.

☑ W B C defend the body against pathogenic diseases.

W B C (Leukocytes) are classified as :

- **Phagocytes** - groups and W B C that engulf or ingest infectious pathogenic micro organisms. They are called phagocytes. They are granulocytes and macro phages.
- **Lymphocytes** - groups of W B C which help to produce antibodies Antigens are foreign proteins substances that enter in to the body.

Plateletes (Thrombocytes)

☑ They are essential role in blood clotting

☑ They are very small. They are smaller than R B C

☑ They do not have nucleus.

☑ Blood clotting has two important functions These are:

☑ It helps to stop bleeding during injury and

☑ It prevents disease - causing pathogenic micro organisms from getting in to the body.

☑ Platelets releases an enzyme which sets chemical reaction in the blood.

☑ The results of the reaction changes fibrinogen, in the blood plasma (Plasma Protein) in to fibrin threads (insoluble fibrin networks)

☑ These networks of fibrin threads then plug in the injured (wound) part, and clotting of the blood (stop bleeding).

The Mechanism Of blood Clotting

$$\text{Plateletes and} \xrightarrow{\text{Produce}} \text{Thromboplastin Wounded tissue}$$

$$\text{Thromboplastin} \xrightarrow[\text{Ca}^{2+}\ \text{k}^{+}\ \text{ions}]{\text{Prothrombin (Plasma protein}} \text{Thrombine}$$

$$\text{Thromboplastin} \xrightarrow[\text{fibrinogen PlasmaProtin)}]{\text{Catalyse}} \text{Fibrin}$$

$$\text{Fibrin} \xrightarrow{\text{Form}} \text{Clotting (Stop bleeding)}$$

Blood Groups

☑ The human blood grouping is A B O - blood grouping system.

☑ The blood grouping depends on which antigens are on the surface of the red blood cells.

☑ Antigens are molecules either proteins or sugar found on the surface of red blood cells.

☑ The types and features of antigens can vary between individuals due to small genetic differences. The antigens in blood have various functions, including :

- Transporting other molecules in to and out of the cell.
- Maintaining the structure of the red blood cells and
- Detecting unwanted cells that could cause illness.

☑ Scientistes use two types of antigens to classify blood groups : These are

i. A B O antigens

ii. Rh antigens.

☑ Antigens and antibodies play a role in the immune systems defence mechanism.

☑ White blood cells produce antibodies.

☑ These antibodies will target an antigen if these consider it a foreign object. That is why it is essential to match blood types when a person needs a transfusion.

☑ If a person recieves red blood cells with antigens that are not present in their system, their body will reject and attack the new red blood cells, counting as if it is a foreign invader. This causes blood agglutination, clumping and sticking together of blood cells, possibly life threatening reaction.

The A B O - Blood Group System

Classifies blood types according to the different types of antigens in the red blood cells and anti bodies in the blood plasma

They use the A B O system along side the Rh - antigen status to determine which blood type will match for a safe red blood cell transfusion.

The Major Blood Groups in Human.

There are four blood groups in human :

i. Blood group - A
ii. Blood groups - B
iii. Blood groups - A B
iv. Blood groups - O

Blood groups - A : The surface of the R B C contains - A - antigen and the blood plasma has anti B - anti body.

- Anti - B - anti bodies would attack blood cells that contain B - antigen.

Blood groups - B : The surface of the R B C contain B - antigen and the blood plasma has - Anti - A - antibody.

- Anti - A - antibody would attack blood cells that contain A - antigen.

Blood groups - A B : The R B C has both A and B antigens , But the plasma does not contain anti - A or anti - B - antibodies

- Individual with type A B - can receive any A B O - blood type.

Blood groups - O : The blood plasma contain both anti - A and anti - B antibodies,

- But the surface of R B C does not contain A or B - antigens.
- Since these antigens does not present, any person can recieves blood type O.

Rh (Rhesus) factors)

Like A B O - blood groups, the Rh - factor is inherited.

☑ Individuals who have this antigen are said to be Rhesus positive (Rh^+). 85 % of the word populations have this antigen. The remaining 15 % of individuals who do not have the antigen are said to be rhesus negative (Rh -)

☑ Individuals who are Rh^- may donate blood to Rh^+ individual, but should not recieves Rh^+ blood.

Table 11 . 3

Individuals who are	Can Donate blood to	Can Recieves Blood from
Rh^+	Rh^+	Rh^+
Rh^-	Rh^-	Rh^-
Rh^-	Rh^+	Not received from Rh^+ blood

☑ The human body has no natural antibodies against Rh - factors, but antibodies can be produced following a transfusion.

☑ Rh - factor incompatibilities become important for Rh^+ babies of Rh^- mother.

☑ If the baby inherits Rh^+ factor from the father a condition called erythroblastosis fetalis.

☑ It is where Rh^- mother's antibody attack the RBC of the Rh^+ fetus.

☑ The first child born safe and escaped the potential dangerous situation. However, a second pregnancy present problems if the fetus is Rh^+, causing them to be destroyed. symptoms includs anaemia, Jaundice, and an enlarged liver.

Antibody : are proteins which are produced and found in the blood plasma.

- They can recognize foreign antigens and destroy foreign antigens (cells).
- It fights against antigen .
- There are two types of anti bodies. These are antibody - a and antibody - b.

☑ There are two types of antigens also namely antigen - A and antigen - B

☑ Antibody - a recoginizes antigen- A as aforiegn protein and anti -

body - b recognizes antigen - B as a foreign protein. This results in the destruction of foreign cells.

Agglutination : is incompatibility of antigen and antibody in blood groups. This results in clumping and sticking together of blood cells.

☑ Blood is a very vital components of the human body.

☑ The process of transferring blood from ahealthy person (the donor) to a person deficient in blood (the recipient) is called blood transfusion.

Table 11 . 4 Antigen and antibodies of different blood groups and their transfusion.

Blood Groulp	Antigens of R B C	Antibodies in the plasma	Donated to	Recieves from
A	A	B	A and AB	A and O
B	B	A	B and AB	B and O
A B	A and B	None	A B- only	All groups (universal recipient)
O	None	A and B	All groups (universal Donor)	O - only

Thus, blood groups "O" is called universal donor and the blood group "A B"is called universal recipient.

Problems Related the to Circulatory System.

Anaemia : is caused when there are few R B C or if the level of haemoglobin is less.

- It is most commonly caused due to lack of iron and vitamin B_{12} in the diet. So it can be treated by eating iron and VB_{12} - rich foods like liver, meat, eggs, fish and green leaves and green leaves and vegetables.

Hypertension : is high blood pressure, in which the systolic and diastolic pressures are increases.

- The high blood pressure is when it is above $\frac{140}{90}$ mm Hg.
- It can be caused by various reasons such as age, over weightiness, high salt consumption, drug addiction, stress, diabetes, kidney problem, etc.

Blood Pressure can be reduced and controlled by :- Eating less salt and fat

- Regular exercises
- Avoid uses of drugs.
- Living easy life and avoid stress - ful life style
- Regular check up.

Conceptual Examples

124.What are adaptations of a red blood cells that equip it for efficient oxygen transport ?

Explanation

R B C ad apptation as efficiicient oxygentransport cell, disc bi concave shape,very thin cell surface membrane and non - nucleated which increase the surface area to carry efficient oxygen to the body cell and tissues.

125. What is plasma ?

Explanation

Plasma is : - the fluid (watery) portion of blood which is yellow tinted water, that carries blood cells (R B C, W B C and Plateletes)

- It also carries digestive and products and food such as amino acids, glucose, fatty acids glycerol, salt fluids, e t c
- It also removes metabolic wastes.
- Plasma also contain blood - clotting factors such as fibrinogens and also contain hormones, enzymes, antibodies, minerals, vitamines, e t c

126.What are the two types of blood antigen and antibody ?

Explanation

The two prominent types of antigen A and antigen B for blood group A and B antigens . But blood group A B has both A and B antigens. But blood group O does not have antigens, Another antigen is the

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Rh - factor.

127.What is the Rhesus factor ?

Explanation

Another antigen on the R B C is called the Rhesus factor. Like the A B O blood groups , the Rhesus factor is inherited Individuals who have this antigen are sad to be Rhesus positive (Rh^+), approximatly 85 % of the population has the antigen and 15 % of the population has the antigen (Rh^-).

128.How does Rh^+ blood differ from Rh^- blood and what happens if the Rh factor of the blood transfused is incompatible ?

Explanation

Rhesus factor incompatibilities become important for Rh^+ baby and Rh^- mother . If the baby inherits the Rh^+ factor from the father, a condition called erythroblastosis fetalis can occur with the second and subsequent pregnancies . The first child is spared because the blood of the mother and baby are separated by the placenta. During birth the placenta is shed from the first time the blood of the baby come in to contact with the blood of the mother . Thus, the blood of the mother produce the anti - Rh^+ in compatibilies occurs.

129.Why does a fetus with erythroblastosis fetalis develop anaemia ?

Explanation

With erythroblastosis fetalis develop anaemia, because the fetus bleeds continuosly and losses blood.

130.Which blood cell is involved in blood clotting (stop bleeding)

Explanation

Plateletes (thrombocytes) are blood cells which are involved in blood clotting (stop bleeding) during injury.

131.Where does W B C (Leukocytes) manufacture ?

Explanation

W B C (Leukocytes) are manufactured mostly in the white bone marrow of long bones. Other sites of manufacture are lymph glands,

such as thymus glands (in the neck), groin, armpit and in the spleen.

Illustrative Examples

132.Which of the following types of blood do not have antigens in its red blood cells ?

A. O B. A C. B D. AB

Explanation

- Blood group "o" have no antigens in its red blood cells.
- Blood group "A B" has antigens in its red blood cells.
- Blood group "A" has antigen A in its red blood cells.
- Blood group " B " has antigen B in its red blood cells.

Answer : A

133.Which of the following blood transfusion is compatible ?

Donor	**Recipient**
A. A	B
B. A	B
C. B	B
D. O	B
E. A B	O

Explanation

Blood group "o" can be donated to all groups. The correct compatibility of the blood is

Donor	**Recipient**
A	A or A B
B	B or A B
A B	A B
O	All

134.Blood transfusion between blood type A and blood type B caused agglutination. This is beeause

A. Type A has antigen B while type B has antigen A

B. Both types of bloods have antigen B.

C. Both types of blood have antibody A.

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D. Type A has antigen A while type B has antibody A.

Explanation

The fusion of antigen - A and antibody a causes agglutination .

Answer : D

135. Which of the following is correct about human blood cells ?

A. White blood cells contain hemoglobin.
B. Red blood cells are fewer than white blood cells.
C. Red blood cells defend the body against disease causing organism.
D. Mature red blood cells do not passes nuclei.

Explanation

It is red blood cells that contain hemoglobin.

- ➥ Red blood cells are smaller and numerous than white blood cells.
- ➥ White blood cells defined the body against disease
- ➥ Mature R B c' s have no nuclei.

Answer : D

136. From which blood group can blood be transferred regardless of the recipient blood group ?

A. A B B. O C. A D. B

Explanation

Blood group "o " can universal donor.

Answer : B

137. Suppose a person lost a lot of blood due to a car accident .it his blood group is "o" for a successful blood transfusion the donor's blood should be

A. A B. O C. B D. A B

Explanation

A person with blood group "o" can receive blood only from blood group "o" can receive blood only from blood group "o".

Answer : B

138. A disease of blood which is inherited from parent is

A. Leukemia C. Varicose Vein
B. Hemophilia D. Elephantiasis

Explanation

Hemophilia is a disease of blood which is characterized by un ability of the blood to clot after cut or damage on the skin which may result in excessive loss of blood.

☑ Hemophilia is hereditary disease that can be inherited from parents to their children.

Answer : B

139. Abebe's father used to suffer from blood clotting problem, Abebe also suffers from the same case what is the most probable cause of their problem ?

A. Elephantiasis C. Hemophiila
B. Varicose - Vein D. leukemia

Explanation

Hemophilia is a blood clotting problem that can be inherited from parents to their children.

Answer : C

140. Which of the following human blood type lacks antibody ?

A. O B. B C. A D. A B

Explanation

Blood type A B has no antibody in its plasma,thus it can receive blood from all blood types

Answer : D

141. Suppose the blood pressure of a person is found to be 140/95 which of the following is true ?

A. The person has a problem of high blood pressure
B. The person needs to increase higher weight.
C. The denominator is the pressure resulting from contraction of left ventricle .
D. The nominator in diastolic pressure.

Explanation

Systolic pressure is created by contraction of the walls of the heart and diastolic pressure is relaxation of walls the heart The normal blood pressure of human is 120 / 00. Thus 140 / 95 indicate high blood pressure which may led to hypertension.

Answer : A

The next question is based on the following table which shows blood type, antigen and antigen on the surface of red blood cells.

Blood type	Antibody in plasma	Antigen on the surface of R B C
A	B	A
B	A	B
A B	No antibody	A and B
O	A and B	X

142. " X " represents

A. Antigen
B. No antigen
C. Antigen A
D. Antigen A and B

Explanation

Blood type 'O' has no antigen on its surface of red blood cells.

Answer : B

143. Which of the following blood cells are involved in blood clotting ?

A. Red blood cell
B. Platelets
C. White blood cells
D. Lymph.

Explanation

Platelets are cells that are responsible for producing proteins which are used to clot the blood after we get injured or cut on our skin.

Answer : B

144. A disease condition caused by uncontrolled production of white blood cells is.

A. Hemophilia
B. Elephantiasis
C. Leukemia
D. Anemia

Explanation

Leukemia is uncontrolled production of W B C s which causes a decline in number of R B S . Its also called blood cancer.

Answer : A

145. Which of the following is true about the blood vessels ?

A. Pulmonary veins carry deoxygenated blood
B. Pulmonary arteries carry deoxygenated blood.
C. Veins carry blood away from the heart.
D. Arteries carry blood to wards the heart.

Answer : B

146. Which of the following components of the blood play important role in clotting blood during injury ?

A. Platelets
B. Red blood cells
C. White blood cells
D. Plasm.

Explanation

☑ Platelets - are cells which are used to clot blood during cut or injury in order to prevent excessive loss of blood from the body.

☑ Red blood cells - Transportation of nutrients, oxygen and other use full substances in the body .

☑ White blood cells - protection of body against disease

☑ Plasma - the liquid potion of the blood.

Answer : A

147. Why is the double circulation so important for warm blooded animals ? Because it.

A. Increasese pumping efficiency of the heart
B. Supplies fully oxygenated blood to all boy cells.
C. Supplies all cells with sufficient amount of nutrients.
D. Carries blood directly from the lungs to the body cells .

Explanation

☑ Double circulation - involves two major circulation these are :

- Pulmonary circulation - the flow of blood from heart to lung and again back to the heart.
- Systematic circulation - is a flow of blood from heart to different parts of the body and back to the heart.

☑ There fore, double circulation is very efficient to supply fully oxygenated blood to our cells.

Answer : B

148. Differente between systemic circulation and pulmonary circulation

Explanation

☑ Systemic circulation - is the flow of blood from left auricle to different parts of the body and back to heart again.

☑ Pulmonary circulation - is the flow of blood from right ventricle to the lung and again back to the heart.

149. Clearly discuss the role of the following blood cells in the body.

➡ Red blood cells

➡ White blood cells

➡ Platelets.

Explanation

☑ Red blood cells - are used to transport substances like oxygen, nutrients, hormones. e t c in the body.

☑ White blood cells - provide protection against disease.

☑ Platelets - play role in blood clotting when our blood vessels are - cut

150. What is agglutination ?

Explanation

Agglutination - is clumping together of blood cells which is caused due to the in compatibility of blood types

➡ It result in death. Thus checking the donors and recipients blood group is very important in order to avoid agglotination

151. Red blood cells carry oxygen all over your body and supply it to your body cells have

A. Hemoglobin

B. Antibodies

C. Nucleus

D. Antigens

Explanation

Hemoglobin is a red piqmented substance that is used to carry

oxygen in the blood . It is manly composed of iron Thus, the lack of iron in the diet causes aneaia.

152. Which of the following methods is used to prevent hypertension ?

A. Eating foods that have iron source

B. Eating canned foods

C. Doing regular exercise

D. Using vitamins.

Explanation

☑ Hypertension is a non - infections disease which is characterized by high blood pressure . Thus it can be controlled by

➡ Eating less salt

➡ Reducing the level of cholesterol

➡ Regular Exercise

➡ Living un stressful and healthy life

➡ Avoid using drugs.

Answer : C

153. The three types of human blood vessels are

A. Aorta, vencava and capillaries

B. Artery, vein and capillaries.

C. Hepatic artery, pulmonary artery and renal artery.

D. Hepatic vein, pulmonary vein and renal vein.

Answer : B

Supplementary Exercises

Part II Multiple choice Items # 2

154. The chamber of the heart that pumps blood relatively to longer distance is

A. Left atrium

B. Left ventricle

C. Right atrium

D. Left ventricle.

155. The muscles of the heart are called.

A. Smooth

B. Cardiac

C. Skeletal

D. Elastic

156. Which of the following chambers of the heart carries oxygenated blood ?

A. Left and right ventricle

B. Left atrium and left ventricle.

C. Right atrium and right ventricle
D. Left and right atrium.

157.The right side of the heart is separated from the left side by ?

A. Pericardium C. Pacemaker
B. Septum D. Cardio scope

158. The valve that is found in between the right atrium and right ventricle is:

A. Semi lunar valve C. Tricuspid valve
B. Bicuspid valve D. Heart valve.

159 Systematic circulation in humans is the flow of blood from ?

A. Heart ⇄ Parts of the body C. Heart ⇄ Lung
B. Parts of the body ⇄ Heart D. Lung ⇄ Heart

160.The type of blood that is known as a universal donor is

A. Type 'A' C. Type 'A B'
B. Type 'B' D. Type ' O'

161. A blood type no antigen is

A. Type ' A B ' C. Type 'A'
B. Type 'O' D. Type ' B'

162.Red blood cells are used in

A. Clotting blood C. Transporting oxygen
B. Defending disease D. Preventing hypertension

163. The types of white blood cells that engulf of disease causing micro organisms are

A. Lymphocytes C. Phagocytes
B. Throm bocytes D. Platelets

164. Which of the following blood transfusion may result in agglutination ?

	Donor	Recipient
A	Type ' A '	Type ' A B '
B	Type ' O '	Type ' A '
C	Type ' A B '	Type ' A B '
D	Type ' B'	Type 'O '

165. All of the following are solid parts of the blood except

A. R B C B. Platelets C. R B C D. Plasma

166.The blood cells that avoid excessive loss of the blood when we are exposed to cut or wound ?

A. W B C B. R B C C. Platelets D. Plasma

167.The shortage of hemoglobin in the R B C may cause

A. Hypertension C. Anemia
B. Leukemia D. Elephantiasis

168.Hypertension can not be reduced by ?

A. Regular exercise C. Healthy life style
B. Eating more salt D. Eating less fat .

169.One of the following is not the major types of blood vessels in the human circulatory system

A. Artery C. Lymph vessel
B. Vein D. Capillary

170.In compatibility of antigen and antibody in human blood group which results in clumping and sticking together of blood cells are called :

A. Agglutination C. Blood disease
B. Hypertension D. Haemophilia

171.Which one of the following is incompatible in Rhesus factors between baby and mother ?

A. Rh^+ - baby and Rh^- mother
B. Rh^+ - mother and Rh^+ - baby
C. Rh^+ - mother and Rh^- - baby
D. Rh^- - mother and Rh^- - baby

172.The pressure of blood is measured by an instrument called

A. Sphygmomanometer C. Thermometer
B. Stethoscope D. Photo light

173.Which one of the following is wrong about the arteries ?

A. They are highly elastic
B. They only carry oxygenated blood
C. They always carry blood away from the heart
D. They have thickest wall

174. All veins carry deoxygenated blood except

A. Hepatic vein
B. Renal vein
C. Pulmonary vein
D. Subcalivian vein

175. During bouble circulation in humans blood moves from the heart to lung for

A. Getting deoxygenated
B. Getting oxygenated
C. Removing oxygen
D. Picking carbon dioxide

Answer : B

Part III Matching Item # 3

Match the following blood vessels with their functions

Column A	Column B
176. Renal artery	A. Supplies oxygenated blood to the Head and neck.
177. Carotid artery	B. Carries deoxygenated blood back to The heart.
178. Hepatic artery	C. Supplies oxygenated blood to the liver.
179. Mesenteric artery	D. Carries oxygenated blood to the Kidney.
180. Venacava	E. Supplies oxygenated blood to the Gut.
181. Jugular vein	F. Carries deoxygenated blood from The head and neck.

Answers

Answer key for supplementary Exercise

154. D
155. B
156. B
157. B
158. C
159. A
160. D
161. B
162. C
163. C
164. D
165. D
166. C
167. C
168. B
169. C
170. A
171. A
172. A
173. B
174. C
175. C

Part II Matching

176. D 177. A 178. C 179. E 180. B 181. F

The Lymphatic System

What is the lymphatic system ?

The lymphatic system is a networks of tissues, vessels,and organs that work together to move a colourless, watery fluid called lymphatic system.

☑ The lymphatic system returns lymph to the venous system.

☑ As blood flows through the capillaries under pressure from the arterial, fluids are squeezed out of the vessels This fluids fille the spaces between the cells and is known as inter cellular fluid or tissue fluid. It is through this fluid that diffusion between the blood and the cells takes place and returnes it to the blood.

☑ The lymph nodes are enlargements that appear in the lymph channel at regular intervals.

☑ Lymph nodes stores lymphocytes in addition to screening damaged cells and debris from the lymph.

The key functions of the lymphatic system

☑ Returns excess interstitial fluid to the blood

☑ Absorb fats and fat soluble vitamines (by lacteals) from the digestive system and transport these substances to the uenous circulation .

☑ The lymph in the lacteal is called chyle, due to high fat content.

☑ The lympetic system protect or defend aginst foreign invaders (pathogens)

☑ It is also parts of our immune system .

☑ Lymphatic vessels contain values.

Organs of the lymphatic System

Along the lymph vessels are lymph glands lymphocytes accumulate in these glands and produce antibodies which are then emptied in to the blood.

The lymph glands also filter out bacteria and other foreign invaders from the lymph to be ingested by the phagocytes.

The Major lymphatic organs of the body are

➡ Lymph nodes
➡ Tonsils
➡ Spleen
➡ Thymus.

i. The lymph nods may swell when a person has a temporary infection. The Swelling of the lymph node occurs as a result of immune cell activities in the lymph nodes. It Is related to the affected area.

ii. Tonsils : are lymphatic tissue clusters located beneath the mucous membranes that line the nose, mouth, and throat (pharynx).

➥ The tonsils lymphocytes and macrophages protect us from harmful substances and pathogens entering the body through the nose and mouth.

iii. Spleen : The spleen is found in the upper left abdominal cavity, just below the diaphragm and posterior to the stomach.

Major functions of the spleen are

☑ Filters the blood in the same way that lymph nodes filter lymph.

☑ Lymphocytes in the spleen react to pathogens

☑ Macrophages engulf debris, damaged cells and other large particles.

☑ Removes old and damaged erythrocytes from the circulating blood.

☑ It produces lymphocytes, in response to infection.

iv. Thymus : The thymus function is to process and mature special lympocytes known as T - lymph ocytes or T - helper cells.

☑ Thymosin, a hormone produced by the thymus, stimulates the maturation of lymphocytes in other lymphatic organs.

11.2.1 Diseases of the Circulatory and lymphatic System

The main Diseases of the circulatory and the lymphatic system are the following

i. Leukemia : is a type of blood cancer that affect the normal functioning and blood - forming tissues cancer including the bone marrow.

☑ Leukemia is uncontrolled production of white blood cells that affect the normal functioning of blood.

☑ There are several types of leukemia. These are :

➥ Acute lymphoblastic leukemia

➥ Acute myeloid leukemia

➥ Chronic lymphocytic leukemia

☑ Treatment for slow - growing leukemia includes

➥ Chemotherapy followed by radiation and stem- cells transplant.

ii. **Varicose veins :** are enlarged, swollen and twisting veins that often that have dark- purple or blue colours mostly seen at the back of legs.

☑ Aching legs, swollen ankles, and spider veins are the symptoms

☑ It occurs when the values in the veins fail to function properly due to prolonged standing.

iii. **Elephantiasis :** is enlargement of the lower part of the body especialy the legs.

☑ It is alymphatic diseases, caused by the accumulation of a fluid (lymph) in the affected area.

☑ Elephantiasis is caused by a parasitic called filaria worm transmitted by a vector culex mosquito.

There are three filaria worm species that cause elephantiasis diseases : These are

➥ Wuche reria bancrofti

➥ Brugia malayi

➥ Brugia timori

The lymphatic system is in charge of eliminating waste and toxins. If it becomes clogged, it is unable to remove waste. This causes the build up of lymphatic fluid, resulting in swelling.

iv. Cardiovascular diseases

Cardiovascular diseases are classified in to several type Among them are

☑ Abnormal heart rhythms, also known as arrhythmias

☑ Aorta disease and marfan syndrome are two examples

☑ Congenital heart disease is a condition that occurs at birth.

☑ Coronary artery disease is a condition that affects the arteries in the heart (narrowing of the arteries) .

☑ Deep vein thrombosis (D VT) and pulmonary embolism (PE)

☑ Heart attack

☑ Heart failure and

☑ Muscle disease of the heart (cardio myopathy).

v. Heart Disease

Heart and blood vessel disease are also called heart disease, many are linked to a process known as atherosclerosis is a condition that occurs when a substance called plague accumulates in the artery walls. This build up narrows the arteries, making blood flows more difficult .

☑ When a blood clot forms , it can obstruct blood flow.

☑ This can result in a heart attack or a stroke.

vi. Heart Attack

A heart attack occurs when a blood clot blocks blood flows to aportion of the heart the part of the heart muscle supplied food and oxygen by that artery begin to die.

vii. Stroke

Stroke is a cerebrovascular disease. It occurs when a blockage or bleed of the blood vessels either interrupts or reduces the supply of blood to the brain when this happens, the brain does not receive enough oxygen or nutrients, and the brain cells start to die stroke occurs when the brain tissues suddenly stop getting oxygen.

viii. Heart Failure

Heart failure, also known as congestive heart failure , occurs when the heart does not pump blood as efficiently as it should.

ix. Haemophilia : It is a hereditary blood disease haemophilia is un ability of the blood to clot (stop bleeding) during injury (during bleeding).

Conceptual Example

182. What are the major functions of the lymphatic system ?

Explanation

☑ Return excess interstitial fluid to the blood

☑ The absorption of fats and fat soluble vitamines from the digestive system and the subsequent transport of these substances to the various circulation

☑ The fats and fat - soluble vitamines are absorbed by the lacteals. The lymph in the lacteals has a milky appearance due to its high fat content and is called chyme.

☑ Defence against invading micro organisms and disease. Lymph nodes and other lymphatic organs filter the lymph to remove micro organism and other foreign particles.

☑ Lymphatic organs contain lymphocytes that destroy invading organisms.

183. Mention the major lymphatic organs of the body ?

Explanation

The major lymphetic organs of the body are lymph nodes, Tonsils, Spleen, and Thymus.

184. Mention the components of lymphatic system ?

Explanation

Components of the lymphatic system includes a fluid (lymph), vessels that transport the lymph, and organs that contain lymphoid tissue.

185. What is the reason for stroke ?

Explanation

Astroke occurs when a blood vessels that supplies the brain becomes blocked and causing a blood clot or when a blood vessels in the brain bursts, blood flows in the brain causing haemorrhage stroke occurs when the brain tissues suddenly stop getting oxygen.

186. Mention the disease caused by disorder lymphatic system.

Explanation

Elephantiasis is a disease of the lymphatic system caused by the accumulation of fluids (lymph) in the lower part of the affected body. It is caused by a parasitic worm called filaria transmitted by a vector mosquito

☑ It is due to the accumulation of lymph, resulting in swelling.

187. Mention the disease of the circulatory system caused by the blockage of food and oxygen to the heart muscle ?

Explanation

The disease called heart attack It occurs when blood containing food and oxygen blocked to reach to the heart muscle.

188. Explain the heriditary disease of the circulatory system ?

Explanation

Haemophilia is a heriditary disease of circulatory system which is unable to clot (stop bleeding) during injury (bleeding)

189. Explain disorder of the circulatory system which occurs when the values in the veins fail to function properly.

Explanation

Varicous veins are enlarged, swollen and twisting veins mostly at the back of the legs which occurs when values in the veins fail to function properly.

11.3 The Breathing System

What is the breathing system ?

The breathing system is a system involved in gaseous exchange between us and the environment (the air).

The respiratory system is vital in order to get oxygen in to the body to oxidize food and release energy for the proper functioning of the body.

☑ All organism need to exchange gas.

☑ The gaseouse exchange is called breathing.

The function of the Breathing system

The primary function of the breathing systems are :

☑ Provide oxygen to body tissues for cellular respiration.

☑ To remove the metabolic waste products, carbondioxide.

☑ Help to maintaind acid base balance and

☑ Portion of the breathing system are also used for non - vital functions such as sensing odors, producing speech, and coughing and sneezing.

The Major structures of the breathing system In human are

- The nose
- Larynx
- Pharynx
- Trachea
- Bronchi
- Bronchioles
- Alveoli

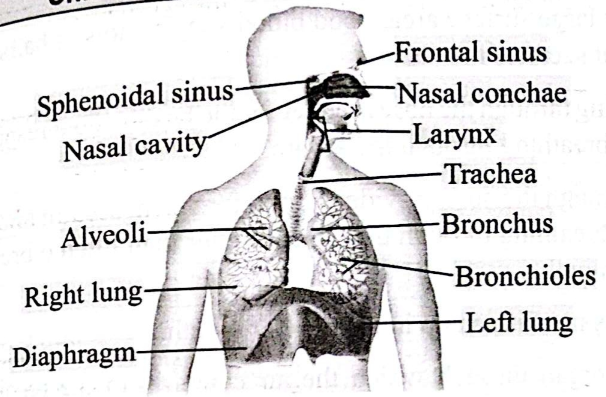

Fig 11.10 The Human Breathing System

Respiratory Systems

What are the respiratory system ?

The respiratory systems have evolved to enable organisms to obtain oxygen and to remove carbon dioxide from their bodies in a process known as gaseous exchange.

For unicellular and simple multicellular organisms obtaining oxygen and getting rid of carbon dioxide (gaseous exchange) is by diffusion.

What does Breathing Involved ?

In human respiratory system, there are two important processes of breathing. This are

Inhalation : The process of taking the air in to the lungs.

Exhalation : The process of removing the air out from the lungs.

☑ Breathing involves a series of pressure changes in the chest cavity.

Inhalation is an active and energy using process.

Exhaletion is a passive processes

The Major Breathing Structures and their Functions

What are the major breathing structures in human ?

The major breathing structures in human are the following . These are :

The Nose /Nasal cavity/ : The nostriles are the main entry and exit points of breathing system .

- ☑ The nose has large surface area, good blood supply , lots of hairs and the lining that secretes mucus.
- ☑ Thus, breathing through the nose is better for the health of our respiratory system than breathing through the mouth.
- ☑ Breathing through the nose provide warmth for the inhaled air and hairs. That is why breathing through the nose is better than filtered breathing through the mouth.
- ☑ But oxygen is not filtered up in the nose or mouth.

Mouth : is an organ through which the air enters in to the respiratory structures.

Pharynx : is the structure that serves as a common passage for both the food and the air.

- ➥ In the throat or pharynx their are six tubes meet at the pharynx these are nasal cavity, mouth, oesophagous, trachea (air pipe) and two eustachean tubes (a tubes connected to the middle ears).

Larynx : The structure that connects the pharynx to the trachea. It is the upper parts of the trachoa.

- ➥ The larynx is called the voice box. This is because, it is where the sound is produced.

Trachea : is the wind - pipe, which is made from C - shaped rings of cartilage called hyaline cartilage. And the C - shaped bone of laynx is called hyoid bone.

This helps to avoid collapsing of the wind pipe. The opening of the trachea is called glottis thus, the entrance of food and dust particles in to the glottis is prevented by the cartilaginous flap called epiglottis. The epiglottis closes when food swallowed, this prevent the entrance of the food in to the trachea.

Bronchi (singular, Bronchus) = are the two branches that arise from the trachea, one (bronchus) leading to each lung.

Bronchioles : are small tubes branching from each bronchus in the lung,

Alveoli : are tiny air - sacks inside the lungs, which are the sites of gaseouse exchange.

- ➥ Exchange of gases are between the alveoli the lungs of the lungs and the blood capillaries.

- ➥ Alveoli are called the functional units of the lungs. It is the site where actual gas exchange takes place.

Table 11.5 Cmparison of Atmospheric and Exhaled Air

Component	Atmospheric Air	Exhaled air
Oxygen	21 %	16 %
Nitrogen	78 %	78 %
Carbon dioxide	0.04 %	4 %
Moisture	Saturated	Varible
Temperature	37^0C	Variable

The Lungs

The lung is the major breathing organ of most animals including humans.

The lung is surrounded by amembraneous structure called pleural membrane, to protect and enclose the lungs.

The lung is spongy and elastic organ which is protected by ribs, sternum, vertebral column, diaphragm, and intercostal muscles.

The Mechanism of Breathing

The process of breathing involves the process of inhalation and exhalation. During This process the breathing system is assisted by the movements of various structures of the body.

Breathing Movements

Pressure differences between the atmosphere and the chest or thoracic cavity determine the movements of air in to and out the lungs.

Gases move from an area of high pressure to an area of low pressure :

- ☑ **Inspiration** occurs when the pressure in side the lungs is less than that of the atmosphere
- ☑ **Expiration** occurs when the pressure inside the lung is greater than that of the atmosphere.

The diaphragm, a dome shaped sheet of muscle that separate the thoracic, or chest cavity from the abdominal cavity, can regulate the pressure in the chest cavity.

Table 11 . 5 The Mechanism of Breathing in Human

	During Inhalation	During Exhalation
➥ Diaphragm	Contract (shorten),flatten and pulling down wards	Relaxes and returns to it's dome - shape
Intercostal Muscle	Muscle contracts	Muscle Relaxes
Rib Cage	Moves up ward and out wards	Moves down wards and inwards
Atmospheric Pressure	Greater than the chest cavity and air moves in to the lungs	Lower thean the pressure in the chest cavity. Air moves out of the lungs
Pressure in the chest cavity (Lungs)	Decreases	Greater than the atmospheric pressure and air moves out of the lungs.
Chest Cavity	Looks bigger (Increases)	Looks smaller (Decreases)
The volume of the chest cavity	Increases	Decreases
Lungs	Inflatted (Filled with air)	Constrictes (deflates)
Air movement	External air pressure drives air in to lungs at low pressure	Air forced out of lungs by thorax compression and elastic recoil of lungs.

The respiratory and circulatory systems work together to provide oxygen to the body and removes carbon dioxide from the body. While oxygen deals with air and carbon dioxide with blood, they work together to coordinate the operations of each systems components .

The total capacity of an inflated lung is about 5 liters. However we do not efficiently use the maximum capacity of our lung. Our breathing is determined by the rate of breathing and depth of breathing.

i. **Rate of breathing** : is the number of breathing

➥ **The normal rate of breathing per unit time in adult human being is 12 - 14 breathes per minute .**

ii. Depth of breathing : is the amount of air breathed.

- Tidal volume is the amounts of air that one can breath in and out at normal resting situation. This about 500 cm^3 (0.5 lt) of air per breath.
- Vital capacity is the maximum amount of air that one can breathe in and out. There fore, as we breathe faster and deeper we inhale more amounts of oxygen in to our lungs .The depth of breathing of an individual is measured by an instrument called spirometer. (Based on the amounts of oxygen breathed in and the amounts of Co_2 breathed out which is nearly balanced.

Disorders of the Breathing System

All breathing disorder share one common characterstic : they all decrease oxygen delivery to the tissues.

Some of the breathing disorders are the followings

Bronchitis

Breathing difficulties can be cased by bacteria or viral illness, as well as reactions to the environmental pollutants.

☑ Bronchit is a condition in which the air ways narrow and the mucous lining of the bronchial tubes becomes inflamed.

Emphysema

The alveolar walls become irritated in emphysema. The air sacs lose their flexibility , stretch , and eventually rupture as a result of exhaling becomes this as a result air is trapped in the lungs and difficult to breathe.

Bronchial Asthma

The Inflammation of the bronchioles is linked to bronchial asthma. Exhaling requires more work than inhaling in asthma.

Common causes for asthma are tobacco smoking, Pollution and allergens such as pollen, mold, dust ,etc.

Illustrative Examples with explanatory note

190.The path followed by air as it enters the human body is

A. Nose → Trachea → Bronchioles → Bronehus → Alveolus.

B. Nose → Bronchus → Trachea → Bronchioles → Alveolus.

C. Nose → Bronchus → Bronchioles → Trachea → Alveolus.
D. Nose → Trachea → Bronehus → Bronchioles → Alveolus.

Answer : D

191. Air leaving the lung differs from air entering the lungs by having.
A. Less oxygen but equal amount of carbon dioxide
B. More oxygen and less carbon dioxide
C. Less oxygen and more carbon dioxide
D. Less oxygen and less carbon dioxide

Explanation

Comparison of inhaled and exhaled air

Gas	Composition in inhaled air %	Composition in exhaled
N_2	78 %	78 %
O_2	21 %	16 %
Co_2	0.04 %	4 %

Answer : C

192. The most important process in lungs takes place in the
A. Pleural cavity
B. Alveoli
C. Bronchioles
D. Bronchi

Explanation

Alveolus are the smallest air sacks in the lung where exchange of gas takes place between the lung and blood capillaries.

Answer : B

193. Which of the following happens during inhalation ?
A. Rib muscles relax
B. Size of the chest cavity decreases
C. Diaphram contracts
D. The air pressure inside the lung increases

Explanation

	During inhalation	During exhalation
Rib muscles	Contracts	Relaxes
Size of chest	Increases	Decreases
Diaphragm	Contracts	Relaxes
Air pressure	Decreases	Increases

Answer : C

194. Which of the following diseases of the breathing system is caused by smoking cigarettes ?
A. Pneumonia
B. Tuberculosis
C. Influenza
D. Emphysema.

Explanation

Emphysema is inflammation of bronchioles which results in breaking down of ouveoli . This is cased due to toxic chemicals smoke.

Answer : D

195. What happens to the concentration of gases in the air with increasing altitude ?
A. The percentage of gases will vary
B. The amount of Co_2 will remain the same.
C. The amount of oxygen will reduce.
D. The composition of air will change

Explanation

As an altitude increases the air becomes less dense. Thus there is less oxygen in a given volume of air at higher altitude .

Answer : C

196. Which of the following parts of the respiratory tract is made up of rings of cartilages ?
A. Trachea
B. Lung
C. Alveoli
D. Bronchiole

Explanation

Trachea is wind pipe which is made up C - shaped rings of cartilage

This helps to keeps the tube open for the passage of air.

197. In human respiratory system, which of the following parts is nearest of the mouth ?

A. Windpipe
C. Epiglottis
B. Larynx
D. Bronchial tubes

Explanation

The pathway of human respiratory system, starting from mouth is indicated as

Mouth → Pharynx → Epiglottis → Larynx

alveoli ← Bronchioles ← Bronchi ← Trachea

198. What happens in our thoracic cavity when the diaphragm contracts ?

A. The lung expands being filled with air
B. The size of the cheast cavity decreases.
C. The diaphragm gets dome shaped structure.
D. The out side air pressure increases as compared to the inner one.

Explanation

During inhalation contraction of the diaphragm and other related structures expands and tills the lung with air.

Answer : A

199. Clean air should Not contain.

A. Oxygen
C. Carbon dioxide
B. Nitrogen
D. Carbon mono oxide

Explanation

Carbon mono oxide is a poisonous gas that reduces the oxygen carrying capacity of the blood which may result in death.

Answer : D

200. If you hold cobalt chloride paper about 3cm from your mouth and breath on it for 2 and 3 minutes, the paper turns pink. This Shows that exhaled air contains.

A. Carbon dioxide
C. Heat
B. Water vapor
D. Oxygen

Explanation

If water is dropped on blue cobalt chloride paper it turns it's color in to pink. Thus exhaled air turns the blue cobalt chloride paper into pink color. This shows the presence of water vapor in exhaled air.

Answer : B

201. What causes muscle fatique after a very hard physical exercise ?

A. Lactic acid
C. Carbonic acid
B. Acetic acid
D. Oxallic acid.

Explanation

During heavy exercise, human body used an arobic respiration to get more energy, There fore glucose molecule split to from lactic acids and 2 A T P S. $C_6H_{12}O_6 \rightarrow 2C_3H_6O_3 + 2ATP$ (lactic acid.)

Answer : A

202. Tidal volume of air is the air which is

A. Inhaled after forced exhalation.
B. Exchanged during a normal breath.
C. Forcible exhaled after normal in halation.
D. Remains in the lung after forced exhauation.

Explanation

Tidal volume - is the air which is inhaled and exhaled at normal condition when we are at resting situation.

Vital capacity - is the maximum amount of air that we can inhale and exhale during condition like heavy exercises.

Answer : B

203. Which of the following happens during breathing air in to the lung ?

A. The ribs move down and inwards.
B. The diaphragm becomes dome shaped.
C. The volume of chest cavity increases
D. The in teraostals muscles relax.

Answer : C

204. What happens when the diaphragm get its dome shape ?

A. Air is withdrawn from the lungs
B. Air is in haled in to the lungs
C. The volume of chest cavity increase

CS CamScanner

D. The pressure in the lung will decrease

Explanation

	During inhalation	**During exhalation**
Diaphragm	Flattens	Becomes dome shaped
Air	Inhaled into lung	Rushes out of the lung
Pressure in the lung	Decreases	Increases
Volume of chest	Increases	Decreases

Answer : A

205. Which of the following methods would you use to test the presence of carbon dioxide in exhaled air ? Breathing on

A. Thermometer
B. Cobalt chloride paper
C. Glass surface
D. Lime water

Explanation

When carbon dioxide reacts with lime water or bicarbonate indicator solution turns cloudy/ yellow, indicating the presence of carbon dioxide

Answer : D

206. The advantage of breathing through the nose is that it

A. Requires less energy to breath
B. Warms and moistens the air
C. Helps to obtain plenty of air
D. Helps to take air at faster rate

Explanation

It's better to breathe through nose rather than breathing through the mouth This is because the nostrils consists of cilia and mucus to prevent entrance of dust particles and also the cilia in the nose moistens and warmth the air.

Answer : B

207. Which of the following breathing structures in located more near to the lung ?

A. Larynx
B. Pharynx
C. Glottis
D. Bronehus

Explanation

Nasal cavity → Pharynx → Glottis → Larynx → bronehus → lung.

Answer : D

Conceptual Example

208. Which of the following actions increases the volume of chest cavity ?

A. Lowering of rib cage
B. Contraction of diaphragm
C. Relaxation of diaphragm
D. Relaxation of the inter costal muscles.

Explanation

During inhalation, the diaphragm contracts and the volume of chest cavity increases.

Answer : B

209. Trace the pathway of the air incoming to the lung.

Explanation

Air in to the human lung is :

Nose and mouth → Pharynx → Trachea → Broneh → Bronchioles → Alveoli

210. List out the major structures that protect out lung.

Explanation

Out lung is one of the delicate organs which can be protected from damages by

- Ribs
- Vertebral column
- Diaphragm
- Inter costals muscles

211. Differentiate between

- Rate of breathing and depth of breathing
- Tidal volume and vital capacity.

Explanation

Rate of breathing refers to number of breath per unit time while, depth of breathing is the amount of air per breathing .

☑ Tidal volume is the amount of air that we breathe at normal situation, while vital capacity in the maximum amount of air that one can inhale and exhale.

212. List out the major factors that affect the normal functioning of the human breathing system.

Explanation

The human breathing can be affected by factors such as exercise, altitude, smoking, disease, anxiety e t c.

213. List out some of the components of the cigarette smoke that may affect our health

Explanation

Smoking cigarette is obviously known to affect the health of the smoker because it contains dangerous chemicals such as tar, nicotine, carcinogenic substances and carbon monoxide .

214. What are the effects of smoking on the smokers health ?

Explanation

Smoking cigarette may cause the following health problems to smoker. These Include :

- ➥ Cancers of lip, throat, lung and other organs.
- ➥ Chronic obstructive pulmonary disease (COP D)
- ➥ Bronchitis and emphysema, e t c

215. Distinguish between passive smoker and active smoker.

Explanation

Passive smoker : is a person who sits or lives with the smoker.

Active smoker : is a person who is directly involved in the smoking.

216. What is artificial respiration ?

Explanation

Artificial respiration is the method of restoring breathing to an individual whose breathing activity is stopped.

217. Mention the disease grouped under the respiratory system

Explanation

Diseases that grouped under the disorders of the resplratory system are :

- ➥ Bronchial asthma
- ➥ Bronchitis and Influenza
- ➥ Emphysema

Supplementary Exercises

Part IV Multiple choice Items # 4

Choose the best answer from the given alternatives

218. The pathway of organs of human breathing system during inhalation is

A. Pharynx → nasal cavity → Glottis → larynx → bronchus → Lung.
B. Nasal cavity → glottis → Pharynx → larynx → bronchus → Lung.
C. Nasal cavity → pharynx → Glottis → larynx → bronchus → Lung.
D. Lung → pharynx → Glottis → larynx → bronchus → nasal cavity.

219. During exhalation

A. Diaphragm relaxes
B. Rib cage moves in and downwards
C. Lung inflates
D. Chest cavity increases

220. All of the following factors affect the rate of breathing, except

A. Altitude B. Exercise C. Light D. Drug

221. Exchange of gas between blood capilaries and lung takes place in the

A. Glottis B. Trachea C. Alveoli D. Pharynx

222. Which of the following is a function of the breathing system ?

A. Gas exchange
B. Absorption of nutrients
C. Transport of oxygen
D. Structural support
E. A and D

223. The trachea leads to the ____

A. Bronchioles
B. Bronchii
C. Oesophagus
D. Pulmonary vessel
E. Nasal cavity

224. The space at the back of the mouth, which leads either to the airway

or the esophagus is the

A. Larynx
C. Pharynx
B. Nasal cavity
D. None

225. Oxygen from the air enters the blood stream through

A. Cardiac notch
D. Paranasal sinuses
B. Pulmonary vein
E. Larynx
C. Alveoli

226. When the diaphragm contracts (is pulled down ward ? ____ occurs.

A. Inhalation
B. Exhalation
C. Hiccup
D. Lung collapse
E. Both exhalation and inhalation

227. The maximum amount of air that one can breathe in and out is

A. Vital capacity
C. Normal breathing
B. Tidal volume
D. Air volume

228. An instrument that is used to measure the depth of breathing is

A. Stethoscope
C. Sphygmomano meter
B. Spirometer
D. Non of the above

229. The powerful addictive chemical found in cigarette smoke is

A. Tar
C. Arsenic
B. Nicotine
D. Carbon monoxide

230. As altitude increase

A. The composition of oxygen increase
B. The air become dense
C. The composition of oxygen decreases
D. The air becomes thinner.

231. A membrane that en closes the lungs to protect, and to reduce friction during breathing movement is

A. Pericardium
C. Septum
B. Pleura
D. Cartilage

232. Which one of the following structures of the heart is correctly matched with its function? (ESSLCE, Hamle 2015 E.C)

A. Right atrium - contracts and forces deoxygenated blood in to the lungs.

B. Left ventricle - contracts and forces oxygenated blood around the body.
C. Right ventricle - contracts and forces blood in to the left ventricles
D. Left atrium - contracts and forces blood into the right ventricle

233. Which one of the following enzyme is correctly matched to the food stuffs it acts on? (ESSLCE, Hamle 2015 E.C)

A. Pepsin - protein
C. Amylase - fats
B. Maltase - lipids
D. Trypsin - starch

Answer Key

For Supplementary Exercise

218. C 221. C 224. C 227. A 230. D 233. A
219. A 222. A 225. C 228. B 231. B
220. C 223. B 226. A 229. B 232. B

11.4 The Human urinary system

The human urinary system consistes of the organs of body which are involved

- A pair of kidneys
- A urethra
- A pair of urethra
- Sphincter muscles
- A bladder

The kidneys : are a pair of bean- shaped organs in the abdominal cavity that are placed directly below the liver.

Ureter : a tube which carries urine from the kidney to the urinary bladder.

Urethra bladder : is a temporary storage site of urine.

Urethra : is a tube that discharges the urine out of the body. In male human it also discharges sperm cell (semen).

Urethrals phincter muscles : are special ring - muscles at the base of the bladder to control the release of urine into urethra.

- There are two urethral sphincter muscle in the human urinary system. They are the upper pyloric sphincter muscle and the lower pyloric sphincter muscle.

The upper pyloric sphincter muscle : It is in voluntary ring muscle that control the release of urine in to urethra.

The lower (External) Pyloric sphincter muscle : is voluntary ring muscle that control the release of urine in to the urethra.

☑ Human being learn how to control the lower (external) pyloric sphincter Muscle in the child hood.

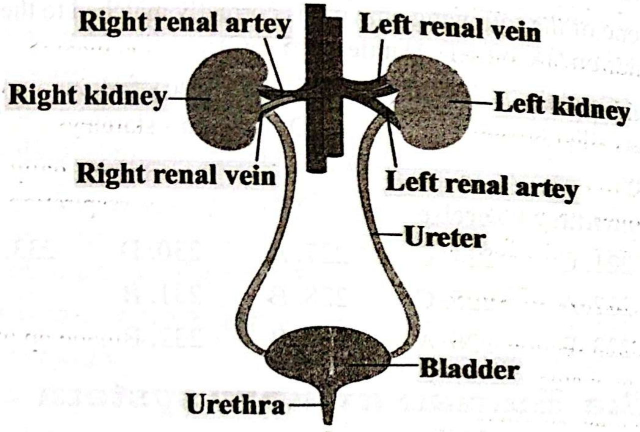

Fig 11.11 The Human Urinary System

Rental artery : supplies oxygenated blood to the kidneys

Renal vein : carries deoxygenated blood away from the kidney in to the inferior vena cava.

Collecting duct : transport urine formed in the kidney down through the medulla and deliver it in to the pelvis to ureters.

Afferent arterioles : supplies blood to glomerulus which are found in the bowman's capsule.

Efferent arterioles : takes blood from glomerulus to the renal tubules.

The major functions of the kidneys

☑ The kidneys have many major functions these are :

- Blood is purified and filtered by the kidneys
- Kidneys remove excess water and keeps the water balance of the body.
- Removes excess salt and keeps the internal mineral balance of the body.
- The regulation of the fluid and mineral ions balance of the body is called **osmoregulation**

- They remove nitrogeneous waste products called urea and ammonia. The removal of metabolic waste products such as nitrogenous waste products (urea) is called **excretion.**
- Thus, the kidney are a homeostatic organ.
- The kidneys are blood plasma regulatory and urine makers.
- The kidneys are also as an endocrine system containing endocrine glands called **adrenal glands** on the top of each kidneys.

The kidneys filter all of the blood in the human body on daily bases, consuming over 25 % of oxygen to carry out aerobic respiration to get chemical energy in the form of A T P.

Internal structure of kidney

The longitudinal section of human kidneys are seen to be made up of three sections on the inside : these are :

- The cortex, an outer region of the kidney.
- The medulla , the midle region of the kidney.
- The renal pelvis in the hilum of the kidney.

The hilum is the concave portion of the bean form where blood arteries and nerves enter and exit the kidney, as well as where the ureters exit.

Medulla consistes of pyramids that opens in the renal pelvis.

Pyramids : The ureter divided in to several branches called pyramids. These pyramids make the internal core of the medulla. The medulla is capped by the cortex.

The renal artery and the renal veins give rise to many arterioles and venules between the cortex (outer part) and the renal peluis in the helum of the kidney.

Nephrons : There are millions of micro tubules in the kidney called nephrons.

- Neprons are the functional units of the kidneys.
- There are about one million nephrons in each human kidney
- Blood filteration and selective reabsorption takes place in the nephrons.

- The urine produced by the nephrons passesvia the renal pelvis and in to the ureters, which transport it to the bladder.

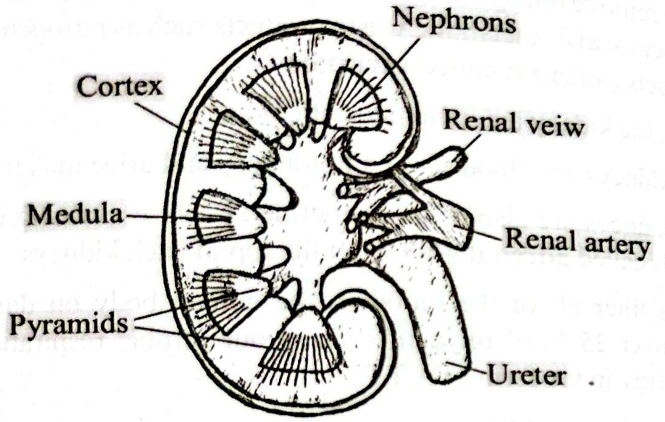
Nephrons
Cortex
Renal veiw
Medula
Renal artery
Pyramids
Ureter

Fig 11.12 Longitudinal Sections of the Human Kidney

The nephrons consistes of a cluster of capillaries known as glomerulus. (glomeruli in plural) .

Bow man's capsule is the first part of the nephron which is a cup - shaped.

☑ The nephron is along tubules which is highly microscopic filtering units in the kidney.

The Nephron Consistes of three Parts

- A renal corpusck
- A renal tubule
- The associated capillary network.

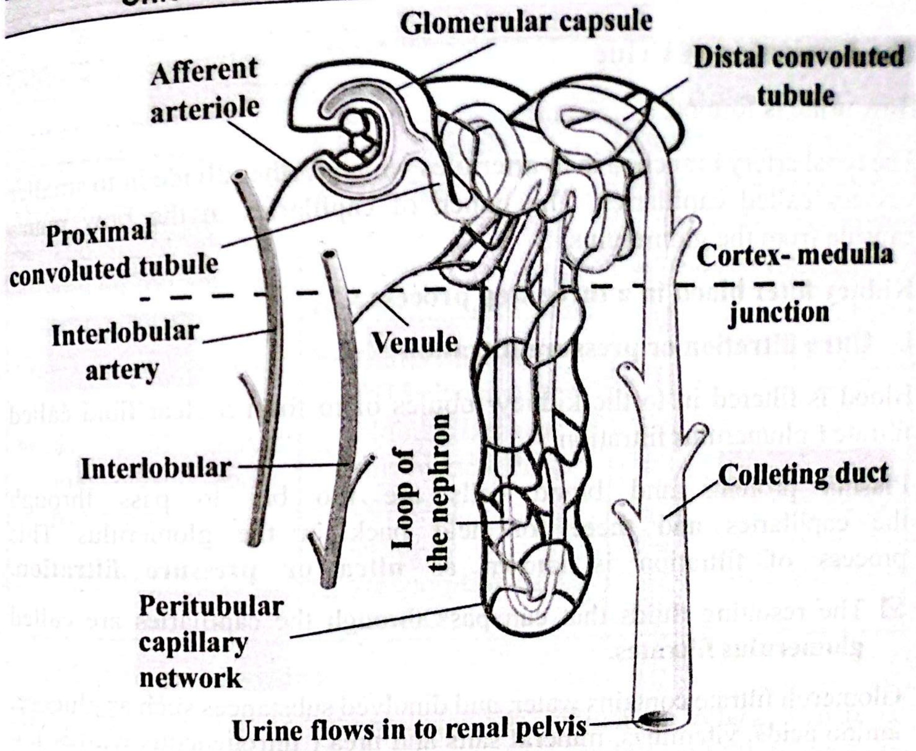
Glomerular capsule
Afferent arteriole
Distal convoluted tubule
Proximal convoluted tubule
Cortex- medulla junction
Interlobular artery
Venule
Interlobular
Loop of the nephron
Colleting duct
Peritubular capillary network
Urine flows in to renal pelvis

Fig 11.13 The structure of a Nephron

Renal corpuscle : The glomerulus, a surrounds the renal corpuscle in the renal cortex, is made up of the glomerular or bow man's capsule, a cup - shaped chamber that surrounds it.

Rental tubule : The renal tubule is along, convoluted structure that emerges from the glomerolus and can be split in to three segments based on functions:

i. The proximal convoluted tubule

ii. The loop of Henle, which forms a loop (with descending and a scending limbs)

iii. The distal convoluted tubule (D C T) . D C T join and discharges the nephron's content in to the collecting duct. Urine will pass via the renal pelvis and in to the ureters.

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The Formation of Urine

How urine is formed ?

The renal artery branched in to arterioles which further divide in to smaller vessees called capillaries. The bunch of capillaries in the bow man's capsule from the glomerulus.

Kidney filter blood in a three step process :

i. Ultra filtration or pressure filtration

Blood is filtered in to the kidney tubules of to form a clear fluid called filtrate (glomerulus filtration)

Plasma proteins and blood cells are too big to pass through the capillaries and there for held back in the glomerulus This process of filtration is known as **ultra or pressure filtration.**

☑ The resulting fluids that can pass through the capillaries are called **glomerulus filtrates.**

Glomeruli filtrate contains water, and dinolved substances such as glucose, amino acids, vitamines, mineral salts and urea (nitrogeneous wastes), e t c.

The plasma proteins and blood cells that are held back in the glomerulus are then returnes back in to the blood stream and to the renal veins in to the blood circulation.

The process of reabsorption occurs in renal tubules These are :

- Proximal (first coiled) convoluted tubule
- Loop of Henle
- Distal (second coiled) convoluted tubule

Table 11 . 6 summary of what Happens in the Nephron (renal tubules)

Proximal tubule	Loop of Henle	Distal tubule
Reabsorption of : ➥ 100 % of glucose and amino acids by active transport ➥ 80 % of water by osmosis ➥ 67 % of sodium ions by active transport.	➥ Further reabsorption of water. ➥ Formation of urine ➥ Maintainance of PH balance of the blood. (Because of this blood - PH is neutral) ➥ Further reabsorption of Na^+ and Cl^- ions.	➥ Water balance by A D H ➥ Reabsorption of salt.

ii. Selective reabsorption

The glomerular filtrate move down the nephrone tubule which is surrounded by a network of capillaries. As it flows along the tubules all of the amino acids, glucose with much water and some salts are absorbed back through the capillary net works in to the blood by the process called selective reabsorption.

☑ This prevents the loss of substances useful to the body.

☑ It is a way of regulating blood composition.

☑ This means that substances that are needed by the body return to the blood.

☑ The blood from the capillaries then returns to the renal vein in to the circulation.

☑ Almost all of the solutes such as glucose, amino acids and vitamines are reabsorbed in the proximal convoluted tubules (P C T), in the first coiled

☑ The filtrate continues to exchange solutes and water with the peritubular capillary Network in loop of henle. During this phase water is also reabsorbed.

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iii. Tubular secretion

☑ It is the inverse of tubular reabsorption

☑ It secretes extra solutes and wastes in to the renal tubules.

☑ The collecting ducts collects filtrate from the nephron, which are then carried to the renal pelvis and finally to the ureters as urine.

☑ Collecting duct is where reabsorb solutes and water from the filtrate and where urine is collected.

The dilute urine consistes of :

- Excess water
- Urea (nitrogenous wastes)
- Mineral salts such as sodium, potassium, chlorine, that are not reabsorbed back in to the blood.
- Urine is transported from the kidneys to the urinary bladder via the ureters.
- The urinary bladder serves as a temporary urine storage reservoir.
- The urethra is the last tube through which urine flows out from the body.
- The urethra is a tube through which both urine and sperm cells (semen) flows out.

Conceptual Example

234. Name the urinary system inhuman ?

Explanation

The urinary system consistes of

- A pair of kidneys
- A pair of ureter
- A bladder
- A urethra
- Sphincter muscles

235. Mention the excretory system of the body ?

Explanation

The excretory systems are systems that excrete metabolic waste products such as urea, carbon dioxide mineral salts, excess water, etc.

The kidneys, the skin and lungs are the excretory system (excretory organs) of human body.

236. Explain the regulation of the concentrations of solutes in the blood by the kidneys ?

Explanation

The kidneys produce 85 % of the erythro protein needed to drive the red blood cells (R B C) formation.

The kidneys also under take the final synthesis step in the creation of vitamin - D. Why the kidneys fails all these functions are weakened and homeostasis disturbed.

237. What do we call the filtrate that leaves the kidneys ?

Explanation

We call it urine. Urine contain excess water, urea, mineral salts, e t c.

238. What are the major functions of the kidneys ?

Explanation

☑ Blood is purified and filtered

☑ Removes excess water and mineral salts (as moregulation)

☑ Removes nitrogeneous waste products such as urea (excretory organ)

☑ Control PH

☑ Secretes hormones as an endocrine system.

239. How the kidneys perform it's function ?

Explanation

The kidneys perform it's functions by pressure filtration (ultra filtration) and selective reabsorption.

240. Mention the renal tubule where a complete reabsorptions of glucous, amino acids and vitamins are takes place ?

Explanation

The first coil (the proximal convolution) is a life where a complete reabsorption of glucose vitamins and amino acids takes place through the capillaries and then returns to the renal vein to the

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circulation of blood.

241. Mention the process of filtration that large molecules such as plasma proteins and blood cells are held back in the glomerulus ?

Explanation

Pressure filtration or ultra filtration.

242. What are the two main immune system in human ?

Explanation

Innate (natural) immune system and acquired (adaptive) immune system.

243. Which immune system is obtained through vaccine ?

Explanation

Acquired (adaptive) immune system is obtained through vaccination.

244. Which cell of the immune system is a phagocytic cell ?

Explanation

The neutrophil is cell of the immune system in which it play a role in the innate immune system by engulfing and then by digesting cellular debris and pathogenes called phagocytic cell.

245. Mention the glomeroli filtrates that can pass through the capillaries ?

Explanation

Glomerulic filtrates are smaller molecules that can pass through the capillaries and where vital substances such as glucose, amino acids and vitamines are completely reabsorbed selectively in the nephrons. These ghomeruli filtrates are water, glucose, amino acids, vitamines, urea, ammonia, mineral salts

246. Which urinary system is that human being learn to control ?

Explanation

Human being learn how to control the lower (external) sphincter

---

muscle in the child hood.

247. Which urinary system in human discharges both urine and sperm cell (sperm cell) in male.

248. Name the tube that carry urine from the kidneys to the bladder ?

Explanation

A pair of ureters carry urine from the kidneys to the bladder.

249. Name the tube that carry urine from the bladder to the out side the body ?

Explanation

Urethra carry urine from the bladder to the out side the body.

250. Summerize the filtration and reabsorption of filtrates by the kidneys in human.

Explanation

Substances	Daily out put in grams		
	Held back by pressure filtration	Glomerular filtrate	Urine contents
Plasma protein	√	No	No
Blood cells	√	No	No
Glucose		200 gm	No
Amino acids		200 gm	No
Sodium		600 gm	6 gm
Potassium		35 gm	2 gm
Calcium		5 gm	0.2 gm
Urea		60 gm	35 gm
Water		180 ℓ	1.5 ℓ
Urine produced			1.5 Litres per day.

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11.5 The Immune System

What is the immune system ?

The immune system is the ability of body to defend against the invasion of pathogens.

The immune system includes varieties of defences against viruses, bacteria, fungus, parasites, and incompatibile other person's blood.

The lymphatic system is parts of the broader immune system.

☑ The immune system enables the body to recognise foreign materials (any thing which is not part of itself).

Types of Immune systems

There are two immune system in human These are

- Innate immune system
- Acquired (adaptive) immune system

I. Innate Immune System

The body's initial line of defence against invading microbial diseases is innate immunity.

Innate immunity is the immunity obtained naturally called natural immunity.

It is where the immunity comes from :

☑ When the body comes in to contact with a foreign antigen, the immune system is activated and antibodies are formed

☑ The other innate or natural immunity that passed between mother and offsprings. Thus, in both cases anti bodies are resulted in the destruction of the antigens.

II. The Acquired (Adaptive) Immune system

After the initial reaction to a new pathogen, acquired (adaptive) immunity is formed, resulting in an increased response to future exposure to the same disease.

Vaccination is based on this acquired immunity process.

The acquired (adaptive) immune system has the following characterstic:

☑ During the antigen presentation process, particular non - self antigens are recognized.

☑ The development of targeted response to eradicate specific pathogen infected cells .

☑ Immunological memory is the process through which signature anti bodies or T - Cell receptors remember each infection.

Cells of the Immune System

The immune system is made up of numerous different cell types and sub types.

The most common types of cells of the immune systems are :

- Lymphocytes
- Neutrophils
- Macro phages
- Dendritic cells

Lymphocytes : They are white blood cells that travel between the blood stream and the lymphatic system.

☑ They are T - Cells, B - Cells and natural killer cells are the three common type of lymphocytes.

☑ Lymphocytes are formed in the bone marrow

Neutrophils : The most common form of W B C, vital role in the innate immune system.

☑ Neutrophils is a type of phagocytics W B C (cells that engulf and then digest cellular debris and pathogens).

☑ **Macro phage :** Phagocytes that play a role in both the innate and adaptive (acquired) immune systems are an other form of phagocytes.

☑ Foreign chemicals (pathogenic bacteria) and cancer cells are all targets for them.

☑ Lymphocytes and other immune cells are also stimulated macrophage to respond to infections.

Dendritic cells : They are found in tissues that come in to contact with the out side world, such as skin, nose, lungs, stomach and gut linings.

☑ They are intermediary between the innate and acquired immune system.

☑ They travel to lymph nodes in response to infection.

Antigens and Anti bodies

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Antigens are foreign protein substance that induces the formation of antibodies.

Antibodies : are also called Immunoglobulins.

☑ Anti bodies are Y - shaped protein substances that produced against the antigen.

☑ They are produced by B - cells that bind to antigens on the surface of foreign substances such as bacteria and viruses.

☑ This binding recognizes and identifies the foreign things as non self prompting other immune cells to attack it .

Hormones and the immune system

The immune system produces a wide range of hormones

☑ Lymphokines are the common name for these hormones.

☑ The immune system is suppressed by steroids and corticosteroids (adrenalin components).

11.6 Renowned Physicians in Ethiopia

1. **Prof. Asrat woldeyes** (1928 - 99) was the first distinguished Ethiopian surgeon and professor of medicine in Addis Ababa university.

2. **Dr . widad kidane mariam**

☑ The first female medical practitioner and top most physician administrator in charge of the medical service division in the minister of Health in the year 1960_s - 1970_s.

☑ The first Ethiopian Gynecologist

☑ The founding organizer for the establishment of the first Ethiopian family planning Association (F P A) as well as maternal and child services for homeless in Addis Ababa municipality.

Conceptual Example

251. Name the most common types cells of the immune system.

Explanation

Lymphocytes, Neutrophils, macrophages Dendritic cells.

252. What is the body's initial line of defence against microbial diseases ?

Explanation

The innate or natural immune system is the initial line of defence against the invading microbial diseases.

253. What is immunity ? Explanation

Explanation

Immunity is the ability to defend the body against the invading microbial diseases.

254. Mention the characterstics of acquired (adaptive) immune system ?

Explanation

☑ During the antigen presentation process, non self antigens are recognized.

☑ Response to eradicate pathogen infected cells.

☑ Immunological memory remember each infection.

255. Where is the manufacturing sites of the immune system ?

Explanation

The immune system of the body manufactured in the bone marrow, spleen and lymph nodes.

End of unit Review Exercise

I Multiple Choice Items Choose the correct answer from the given Alternatives

1. Part of the alimentary canal where mechanical digestion and the chemical digestion of poly saccharides begin.
   A. Mouth
   B. Stomach
   C. Liver
   D. Small intestine
   E. None of the above
2. The 1st location in the digestive system where peristalsis occure.
   A. Mouth
   B. Esophangous
   C. Stomach
   D. Small intestine
   E. Large intestine
3. Where in the alimentary canal does pepsinogens are activated in to

pepsin to aid in the digestion of proteins.

A. Mouth
D. Small intestine
B. Esphagous
E. Large intestine
C. Stomach

4. The organ that releases many enzymes that aid in the break down of all types of organic moleculles.

A. Mouth
D. Liver
B. Gall Bladder
E. Pancreas
C. Stomach

5. The tube though which food and air (that you breathe) passes.

A. Esophagous
D. Pharynx
B. Larynx
E. Rectum
C. Trachea

6. Bile is produced in __________ .

A. Salivary Glands
D. Liver
B. Pancreas
E. Gall bladder
C. Stomach

7. Which one of the following is a protease enzyme ?

A. Lipase B. Erepsin C. Sucrase D. Amylase

8. The digestive process that takes place in the mouth is .

A. Starch $\xrightarrow{\text{amylase}}$ maltose

B. Maltose $\xrightarrow{\text{maltase}}$ glucose

C. Protein $\xrightarrow{\text{pepsin}}$ peptone

D. Fat $\xrightarrow{\text{lipid}}$ fatty acid and glyoerol

9. Which one of the following is a solution of gastric juice ?

A. Lipase B. Trypsin C. Pepsin D. Amylase

10. All of the following are properties of enzymes except.

A. Are specific
C. Can be reused
B. Are carbohydrates
D. Are catalysts

11. Enzymes such as sucrase, lipase, maltase and erepsin are secreted by.

A. Pancreas
B. Intenstinal wall

C. Gastric wall
D. Salivary gland

12. An enzyme that converts starch in to maltose is.

A. Pepsin B. Maltose C. Lactose D. Amylase

13. The part of human digestive system where the process digestion ends and absorption takes place is.

A. Duodenum
C. Jejunum
B. Ileum
D. Esophagus

14. The hardest protective layer of the teeth is .

A. Dentine
C. Pulp cavity
B. Enamel
D. Crown

15. A salty substance in the duodenum that is used to emulsity fat is .

A. Chyme B. H C l C. Bile D. Feaces

16. The role of liver in human digestive system is.

A. Secretion of bile
C. Secretion of saliva
B. Producing H C l
D. Emulsification of fat

17. Which of the following organs produce insulin, required for glucose up take in to body cells ?

A. Liver
D. Stomach
B. Gall bladder
E. None of the above
C. Pancreas

18. Which of the following is not a major task of the digestive system ?

A. Secretion
C. Absorption
E. Circulation
B. Digestion
D. Elimination

19. Which of the following is not considered an accessory gland to the digestive system ?

A. Wall of the gastrointestinal tract G I T)
B. Salivery glands
C. Liver
D. All of the above

20. Rank the following blood vessels in order of their average pressure, from highest to lowest. Artery, vein, arteriole, venule, aorta, capillary.

A. Capillary > vein > venule > arteriole > artery > aorta
B. Aorta > arteriole > venule > artery > vein > capillary
C. Aorta > artery > arteriole > capillary > venule > vein

D. Capillary > arteriole > venule > artery > vein > aorta

E. None of the above.

21. The correct path of urine takes asit moves through the urinary system______ .

A. Kidneys → ureter → bladder → urethra

B. Ureters → bladder → urethra → kidneys

C. Bladder → urethra → kidneys →ureter

D. Urethra → bladder → ureter → kidneys

22. Which of the following statment about circulatory systems is false ?

A. In closed circulatory system blood flows through vessels that are separate from the interstital fluid of the body.

B. The earth worm has a closed circulatory system

C. In an open circulatory system the hemolymph empties in to the body cavity.

D. Lobsters are organisms that have closed circulatory system.

23. Red blood cells are also known as.

A. Lymphocytes

B. Monocytes

C. Erythrocytes

D. Basophils

24. How does the structure of red blood cells allow them to deliver oxygen to the cells of the body ?

A. Their size and shape allow them to carry and transport oxygen.

B. Their disc shape contains many small vesicles that allow them to carry and transfer oxygen

C. They have nuclei and do not contain haemoglobin

D. They contain coagulation factors and antibodies

E. All of the above

25. Which of the following best describes plasma ?

A. It is a protein synthesized in the liver.

B. It is a liquid that contains only lipids and antibodies.

C. It is a blood component that is separated by spinning blood

D. It is An antibody produced in the mucosallining.

E. All of the above except A

26. Which of the following substances are not filtered out of the blood in the nephrons ?

A. Blood cells and proteins

B. Glucose and amino acids

C. Urea and water

D. Salts and hormones

E. A and C

27. The ___ is the functional unit of the kidney.

A. Villus

B. Alveoli

C. Lymph node

D. Nephron

E. All of the above

28. All of the substances that are removed from the blood via the bowman's capsule are called ______ .

A. Plasma

B. Filtrate

C. Urine

D. Lymph

E. C and D

29. What substances must be reabsorbed back into the blood from the convoluted tubule and loop of Henle ?

A. Water

B. Salts

C. Glucose

D. All of the above

E. None of the above

30. Urine is primarily composed of.

A. Lymph

B. Red blood cells

C. Carbon dioxide

D. Water

E. Oxygen

31. What s the role of liver in the maintenace of homeostasis ?

A. Stores extra carbohydrates in the from of glycogen .

B. Produces bile to aid in fat digestion

C. Produces clotting proteins

D. All of the above

E. Only A and B

32. The value which is found between right atrium and right ventricles is.

A. Bicuspid valve

B. Tricuspid valve

C. Mitral valve

D. Semilunar valve

33. Which two chambers of the human heart contain oxygenated blood ?

A. Right auricle and left ventricle

B. Left ventricle and left auricle

C. Left auricle and right ventricle

D. Right ventricle and right auricle

34. Which of the following explains sequential steps of nutrition ?

A. Absorption → digestion → Ingestion → assimilation

B. Digestion → Ingestion → Assimilation → Absorption
C. Ingestion → Digestion → Absorption → Assimilation
D. Ingestion → Digestion → Assimilation → Absorption.

35. Which of the following values of the heart is opened by the blood forced out of the right ventricle
A. Tricuspid valve
B. Bicuspid valve
C. Semilunar valves of the aorta
D. Semilunar valves of the pulmonary artery

36. The windpipes such as trachea and bronchi are always kept open by means of
A. Arterial blood pressure C. Muscles in their walls
B. Atmospheric gas pressure D. Ring of cartilages

37. The chamber of the heart which pumps blood over a longer distance than the rest ?
A. Left auricle C. Left ventricle
B. Right auricle D. Right ventricle

38. What does the red blood cell lack the white blood cell has ?
A. Hemoglobin C. Cell membrane
B. Nucleus D. Cytoplasm

39. The correct order of air passage during inhalation takes places through.
A. Bronchus → trachrea → bronchiole → alveolus
B. Trachea → bronchus → bronchiole → alveolus
C. Trachea → bronchiole → bronchus → alveolus
D. Bronchus → bronchiole → alveolus

40. Which of the following is true about anaerobic respiration ?
A. A T P is produced
B. Lactic acid is degenerated
C. Glucose releases all its energy
D. Oxygen is required

41. The quickest source of energy for the muscle is
A. Glucose sugar C. Starch
B. Maltose sugar D. A T P

42. The exchange of materials between the blood and tissues of the body

takes place in the
A. Venuole C. Arterioles
B. Arteries D. Capillaries

43. In the process of oxidation in a cell, the energy released from the food is trapped by molecules of
A. Glucose C. Adenosine triphosphate
B. Oxygen D. Adenosine diphosphate

44. Which of the following has the thickest wall ?
A. Left auricle C. Right auricle
B. Left ventricle D. Right ventricle

45. Which of the following is correct sequence of blood flow in mammals ?
A. Pulmonary vein → left auricle → left ventricle → aorta
B. Pulmonary vein → right auricle → pulmonary artery → lung
C. Vena cava → right auricle → pulmonary vein → left ventricle
D. Left auricle → left ventricle → pulmonary artery → lung

46. Which of the following blood diseases are heritable ?
A. Leukemia C. Leukemia
B. Hemophilia D. Hypertension

47. If you cut your finter , blood comes out and then stops flowing this is due to clotting of blood by.
A. Platelets C. White blood cells
B. Antibodies D. Red blood cells

48. If a person climbing a high monutain was found to be taking faster and deeper breaths. This shows that.
A. The proportion of oxygen in the air he is breathing is much more lower than in the lower altitude.
B. At higher altitude the rate of breathing is much lower
C. Air at high altitude is less dense and a person would need to breathe more quantity of air
D. The percentage of oxygen in the air decreases .

49. Which of the following statement is true ?
A. We breathe in oxygen and breath out carbon dioxide.
B. The air we breathe out contains more carbon dioxide. Than the air we breath in.

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C. The air we breath in and we breath out contain the same amount of oxygen.

D. The exhaled air contains more carbon dioxide than oxygen.

50. During the process of breathing in air .

A. The lung inflates

B. The volume of chest cavity decreases

C. The diaphragm be comes dome shaped.

D. The rib muscles relax

51. The structure that protects the windpipe from being choked with food is the

A. Esophagus

B. Epiglottis

C. Rings of tracheal cartilage

D. Larynx

52. Which of the blood vessels has the greatest surface area ?

A. Arteries

B. Veins

C. Capillaries

D. Arterioles

Part II True false items : Say True or false for the following statments on your exercise book

53. Blood pressure is highest in veins .

54. Atherosclerosis is the build up of plaque inside arteries.

55. Platelets are blood cells that fight infections.

56. Food travels from the mouth to the stomach because of gravity.

57. Most absorption of nutrients takes place in the stomach.

58. For good health, you should never eat lipid.

59. The kidneys are the main organs of the excretory system .

60. Nephrons carry urine out of the body.

Part III Fill in the Blanks Fill in the blank with the term that best completes the sentences.

61. Blood pressure that is higher than normal termed ___

62. The liquid part of blood is referred to as ___

63. Blood type is determined by the presence or absence of ___ on blood cells.

64. Tiny sacs in the lungs where gas exchange takes place are called ___

65. The disease in which air passages of the lungs periodically become too narrow is ___

66. A wave of involuntary muscle contractions that moves food through the digestive system is called ___

67. The physical break down of chunks of food in to smaller pieces is reqerred to as ___ digestion.

68. The sall intestine is lined with tiny finger like projections named ___

69. Solid waste that leaves the large intestine is known as ___

70. Nutrients needed in small amount for the body to function properly ___

71. ___ Is the process of obtaining and utilizing food.

72. The churning movement of the food along the oespohagus is called ___

73. ___ Is the right type and precise amount of food required for the healthy state of the body.

74. Carbonydrates are made up of elements ___, ___, and ___

75. ___ Are biological catalysts.

76. A fat emulsitying salt which is produced by the liver is called ___

77. The deficiency disease of vitamin A is called ___

78. Simple sugars join to form a double sugar by the reaction known as ___

79. The storage from of carbohydrates in plants is ___ , while the storage form in animals is called ___

80. The part of the human digestive system which has both digestive and absorption role is ___

81. The chemical digestion of carbohydrate starts in the ___ and ends in the ___

82. The three enzymes that are found in pancreatic juice are ___, ___ and ___

83. The process of taking air in to the lung is called ___, while the act of expelling air from the lung is called ___

84. In voluntary muscles of the heart are called ___

85. The entrance food and dust particles in to the wind pipe is prevented

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by __

86. The functional units of the lungs where exchange of gas takes place are called ___

87. ___ Is the amount of oxygen needed to break the lactic acid produced during the anaerobic respiration in animals .

88. The powerful addictive chemical which is found cigarette smoke is called ___

89. The largest veins are called __, while the smallest veins are called. _

90. The blood vessels that carry the blood away from the heart are _

91. The contraction of the muscles of the heart is ___ , while the relaxation of the muscles of the heart is ____

92. The back flow of the blood in the human circulatory system is prevented by __.

93. Blood type 'o' is called __, while blood group 'A B' is called __ .

94. The un controlled production of white blood cells that leads to blood cancer is called __

95. The disease which is characterized by failur of the body to clot blood after injury is __

Answer Keys
To End of unit Review Exercises
Part I Multiple Choice Item

1. A
2. B
3. C
4. E
5. A
6. D
7. B
8. A
9. C
10. B
11. B
12. D
13. B
14. B
15. C
16. A
17. C
18. E
19. A
20. C
21. A
22. A
23. A
24. C
25. C
26. A
27. D
28. B
29. A
30. D
31. A
32. B
33. B
34. C
35. D
36. D
37. C
38. B
39. B
40. A
41. D
42. D
43. C
44. B
45. A
46. B
47. A
48. C
49. B
50. A
51. B
52. C

Part II True / False Item

53. False
54. False
55. False
56. False
57. False
58. False
59. False
60. False

Part III Fill in the blanks Items

61. Hypertension
62. Plasma
63. Antigen
64. Alveoli
65. Asthma
66. Peristalsis
67. Mechanical
68. Villi
69. Bowl
70. Minerals
71. Nutrition
72. Peristalsis
73. Balanced diet
74. Carbon, Hydrogen and oxygen
75. Enzymes
76. Bile
77. Night blindness
78. Condensation reaction
79. Starch / glycogen
80. Ileum
81. Mouth/ Ileum
82. Trypsin/ amylase, and lipase
83. Inhalation/ Exhalation
84. Cardiac muscle
85. Epiglotis
86. Alveoli
87. Oxygen depth
88. Nicotine
89. Vena cava/ venuoles
90. Arteries
91. Systole ; Diastole
92. Valves
93. Universal donor ; universal recipients
94. Leukemia
95. Haemophilia

UNIT 12

Ecological Interaction

12.1 Trophic Levels

What is trophic level?

☑ Trophic level is a feeding level to which an organism belongs.

☑ With in any habitat living organisms depends on plants called producers.

☑ Producers are called autotrophes.

☑ The primary food producers provide the food on which all of the rest of the organisms depend.

☑ The different levels with in the food chain the producers, herbivores, carnivores, etc. are known as the trophic levels.

☑ Each organism occupies particular trophic level with in the food chain.

12.1.1 Food Chain and Food Web

Food chain:- is a simple and direct feeding relation ship between organisms.

- Uniderectional food relationship.
- In food chain energy flow is unidirectional (food producers to consumers).

The Main Trophic Levels in the Food Chains are

i. Producers (first trophic level).

- Producers are green plants and algae. They can produce their own food and energy by the process of photosynthesis.

- Photosynthesis involves the conversion of light energy from the sun in to chemical energy (food).
- All organisms depend directly or indirectly on producers. The are found at the bass of all feeding level.
- The sun the ultimate sources of energy for all food chain.

ii. **Primary consumers:-** They are second trophic level.

- It in cludes herbivores that can eat plants directly and also include omnivores.

iii. **Secondary consumers**

- Third trophic level
- They are called top carnivores, they are mostly eat herbiveres. It also contain omnivores.

iv. **Tertiary consumers**

- Fourth trophic level
- They ere called top carnivores.

Additional quaternary (fifth trophic level) consumers may be present in some food chain.

☑ Decomposers are bacteria and fungi They are found at the end of each food chain. Food chain can be categorised in to terrestrial and aquatic food chains.

Terrestrial (land) food chain

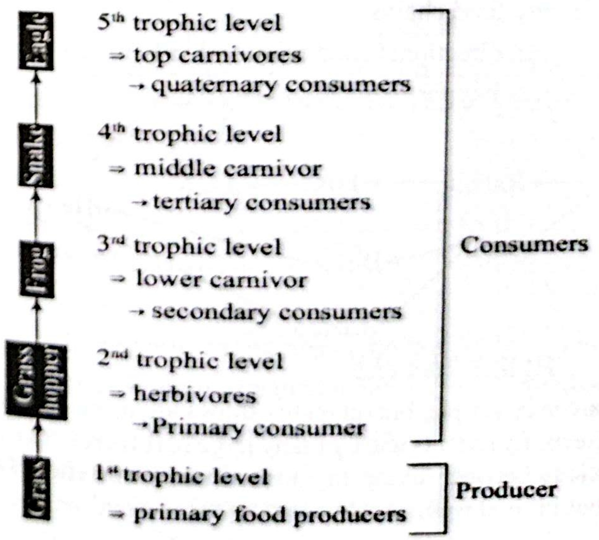

Eagle
5th trophic level
⇒ top carnivores
→ quaternary consumers
Snake
4th trophic level
⇒ middle carnivor
→ tertiary consumers
Frog
3rd trophic level
⇒ lower carnivor
→ secondary consumers
Grass hopper
2nd trophic level
⇒ herbivores
→ Primary consumer
Consumers
Grass
1st trophic level
⇒ primary food producers
Producer

Fig 12.1 Terrestrial Food Chain

Aquatic Food chain

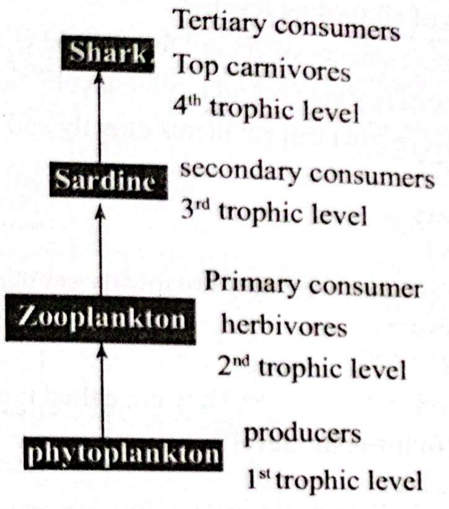

Shark
Tertiary consumers
Top carnivores
4th trophic level
Sardine
secondary consumers
3rd trophic level
Zooplankton
Primary consumer
herbivores
2nd trophic level
phytoplankton
producers
1st trophic level

Fig 12.2 Aquatic Food Chain

Food wed

☑ Food web is too complex feeding relationship between organisms that consistes of many food chains.

☑ Food web is multi directional food relationship between organisms.

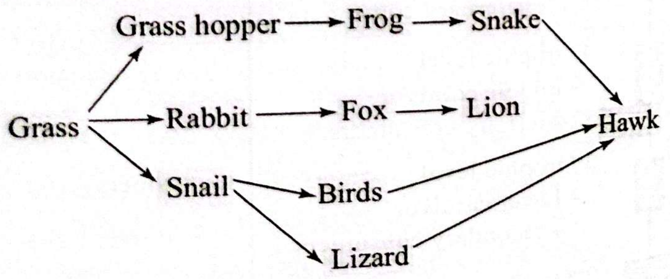

Grass hopper
Frog
Snake
Grass
Rabbit
Fox
Lion
Hawk
Snail
Birds
Lizard

Fig 12.3 Food Web

Food chains are very simple, but on reality things are more complex. Grass is eaten by insects, by rodents and by many large herbivores. The many The many in tractions between living organisms can not be shown in simple food chains but in food web.

Based on their mode of nutrition, organisms can be grouped in to two major groups. These are:

i. Autotrophic nutrition
ii. Heterotrophic nutrition

1. **Autotrophs:** Organisms which can synthesis their own food.
   - They drive energy from the sunlight.
   - They are called producers.

☑ Sunlight is the uitimate sources of energy for living organisms. Autotrophes can be classified as:

A. Photoautotrophs
B. Chemoauttrophas

A. Photoautotrophs: organisms that can systhesis their own food.

- They used sun light as a sources of energy to synthesis organic food.
- They are sources of food for other organisms like animals.

Example Green plants, algae, phytoplankton blue green algae (cyan bacteria) are photoautotrophic.

- They are primary food producers.

B. Chemoautotrophic: Organisms can release (drive) energy from simple chemical reactions.

- The sources of energy is chemical reaction

  Example: Chemoauthtrophic bacteria are bacterial living in extreme conditions. They are called Thermophilic, hallopilic and methanophilic bacteria.

2. **Heterotrophs**
   - Organisms that can be not make their own food.
   - They are called consumers.
   - They feed on other organisms.
   - They are herbivores, carnivores omnivores and also decomposers.
   - They depend on producers directly or indirectly for food.

The Major Characterstic of Food Chain

- Food chain represent nutritive interaction among biotic components of the ecosystem. It is to eat or to be eaten.

- Producers (aurortophs) are plants found at the base (beginning) of the food chain.
- There is the unidirectional flow of energy from the sun to the producers and then to series of consumer, but in reality food chain is different from food web in this context.
- **The major characterstics of food web;**

☑ **In food web:** ecosystem normal exhibit multidirectional energy flows, which is more than a direct chain of who - eats - what.

- What occuring in the ecosystem is a complex web structure called the food web.
- A food web is an interconnected food chain that make an interwoven or web - like structure.

Conceptual Example

Part I. Give short Answer for the following Questions.

1. How many food chains are their in the following food web.

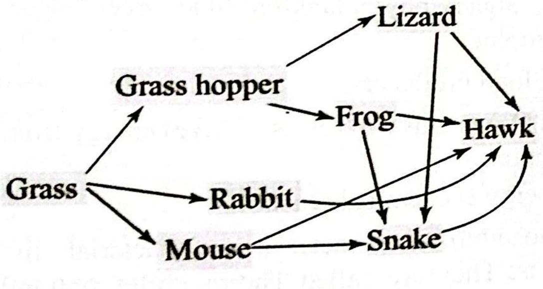


Fig 12.4

Trace all the available food chains from the food web given above.

Explanation

Number of chains traced from the above food web are:

i. Grass → grass hopper → lizard → Hawk
ii. Grass → grass hopper → lizard → snake → Hawk
iii. Grass → grass hopper → frog → Hawk
iv. Grass → grass hopper → frog → snake → hawk
v. Grass → mouse → Hawk
vi. Grass → mouse → snake → Hawk.

There are six food chains are in the food wed

2. Compare food chain and food web.

Explanation

Food Chain	Food Web
☑ Direct feeding level	☑ Complex type of feeding level
☑ Simple feeding level	☑ Multidirectional food relation ship.
☑ One - directional food relation ship	☑ Contain many food chains

3. Explain the major characterstics of food web?

Explanation

- Food web normally exhibit multidirectional food relation ship (energy flows).
- Food web is more than direct chain of "Who - eats - what "
- It is a complex web structure occuring in the ecosystem, which means an inter connected food chain that make an inter woven or web - like structure.

4. Mention the major characterstics of food chain?

Explanation

- Food chain is very simple feeding relationship
- It is one directional food relationship, on the bases of "Who - eats - what" But in reality things are more complex.

5. Compare and contrast the primary and the secondary consumers.

Explanation

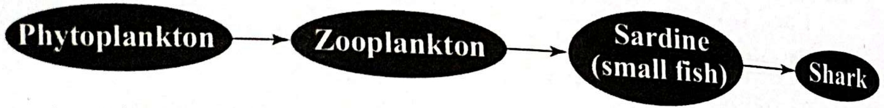
- The primary consumers are belongs to the second trophic level.
- They depends on primary producers for food.
- They eat plants and their products.
- They are called herbivores.
- It also contain omnivores.

The secondary consumers depends on the mary consumers for food.

They belongs to the 3rd trophic level.

- They are lower carnivores. They eat herbivores.
- They also contain omnivores.

6. Based on the aquatic (water) food chain shown below, which organism occupies.



i. Primary consumer ________________

ii. Primary producer ________________

iii. Herbivores ________________

iv. Third trophic level ____________

v. The highest carnivores __________

Explanation

The primary consumers are zoo planktons.

The primary producers are phytoplankton

Herbivores are zoo plankton

The third trophic level are sardines (small fish)

The highest (top) carnivores are shark.

Key terms

Photo plankton: aquatic autotrophic that contain green pigment to carry out photosynthesis. They are found at the base E.g Euglena algae.

- They are microscopic organisms.

Zoo plankton: Small animals called herbivores or consumers that feed on phytoplankton in the food chain.

Illustrative Example

7. Which one of the following is a consumer?

A. Plant B. Grass C. Sheep D. Algae

Explanation

Algae, grass & plants are producers but sheep is a consumer.

Answer: C

8. Autotrophs are ______

A. Primary consumers C. Producers

B. Secondary consumers D. Higher carnivores

Explanation

Producers are called autotrophs. They can make their own food by photosynthesis

Answer: C

9. The organisms that feed on dead organic matter are called ______

A. Producers C. Decomposers

B. Consumers D. Chemoautotrophs

Explanation

Bacteria and fungus are called decomposers. They decompose dead organic matter.

Answer: C

10. The following one is found at the end of the food chain, which one?

A. Plant B. Fungus C. Grass D. Flower

Explanation

All organisms are dead and decomposed. Decomposer are fungus & bacteria. They are found at the end of each trophic level.

Answer: B

11. Which one of the following is **wrong**

A. Herbivores are found in the 2nd trophic level.

B. Carnivores are consumers.

C. Lion is found at higher trophic level.

D. Some times producers can be consumers

Explanation

Producers can not be consumers.

Answer: D

12.1.2 Flow of Energy and Matter Throug the Ecosystem

☑ Solar energy (Sun light energy) trapped by the producers during photosynthesis enter energy in to the econsystem. This energy flows through a series of organisms by a food chain and food web.

☑ The energy from the sun flows through organisms But this energy can not go back to the sun.

☑ That is why we say energy flows but can not be recycled.

☑ Energy flows through the ecosystem.

☑ How ever, nutrients in food recycled in the ecosystem and reused over again.

☑ This is the results of composition (synthesis) and decomposition (synthesis) which take place in the ecosystem.

☑ When energy flows from one trophic level to the next it successively decline in amounts.

☑ **Death and decomposition:** organisms (plants and animals) died and decomposed (decayed) by decomposer (bacteria and fungi)

☑ Bacteria and fungi (decompsers) obtain energy for their own by breaking down of dead organic matter.

☑ Decomposers return key nutrients like nitrogen to the soil so that producers can use them.

Ecological Pyramids

☑ What is pyramid?

☑ Pyramid is the diagram that used to express the amounts of organisms present in each trophic level.

☑ Pyramid is used to express the number of organisms, the total organic mass and the amounts of energy of organisms in the trophic level.

Ecological Pyramid
- Pyramid of numbe
- Pyramid of biomas
- Pyramid of Energy

A. Pyramid of Number: are the number of organisms in each trophic level.

- ➥ The producers have large numbers and top carnivores have less number.

- ➥ The number of organisms decrease on going from base (producers) to higher (top) carnivores.

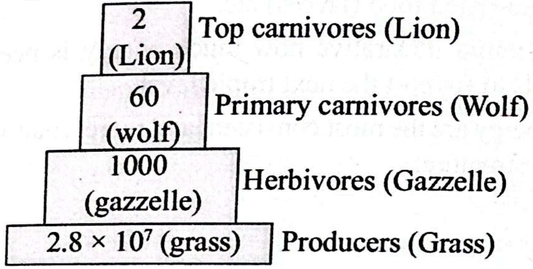


Fig 12.5 Pyramid of Number

B. Pyramid of Biomass: Biomass is the total organic mass or matter of organism in each trophic level contained or assimilated to the body of an organism per unit time.

- ➥ Producers have high biomass and top carnivores (top trophic level) has less biomass.
- ➥ Not all ingested plants are digested and used by animals so it passed out as faeces, urine, etc.
- ➥ Thus, biomass decreases on going top the trophic level

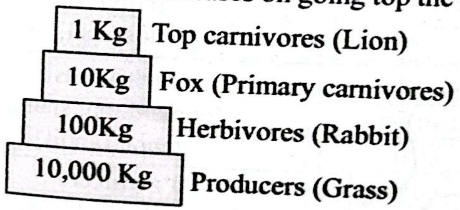


Fig 12.6 Pyramid of Biomass

C. Pyramid of Energy: The amount of energy producers get from the sun is loss in the trophic level.

- ➥ Energy flows in the food chain from producers (autotrophs) to the top trophic level.
- ➥ When energy flows from producers to the next trophic level, it decreases.
- ➥ Energy never be recycle but energy flows in the trophic level (food chain).
- ➥ When energy flows from one trophic level to the next it successively

declines in amount during movement, respiration,feeding digestion, removal of undigested food (faeces) etc.

- An energy pyramid illustrative how much energy is needed as it flows up wards to support the next tropic level.
- Pyramid of energy are the most consistent and representative models of ecosystem structure.

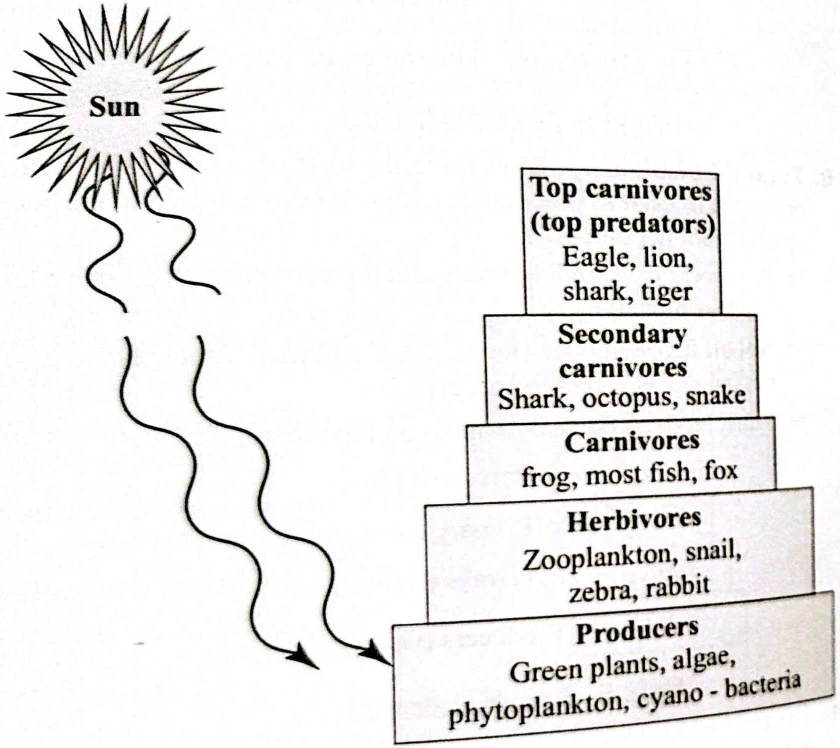
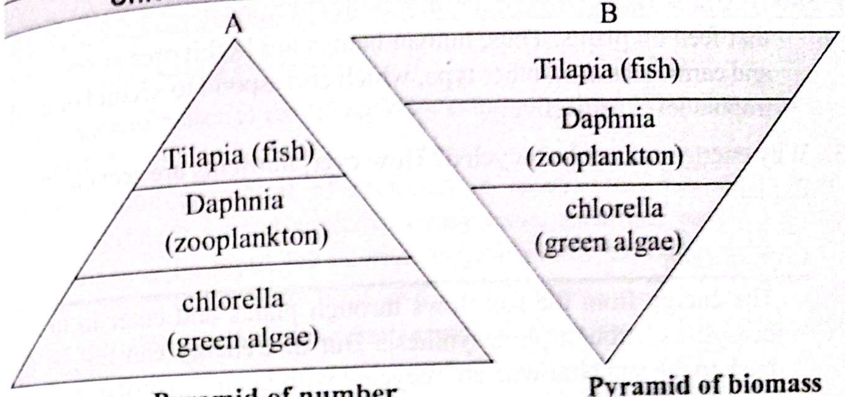

Sun
Top carnivores (top predators)
Eagle, lion, shark, tiger
Secondary carnivores
Shark, octopus, snake
Carnivores
frog, most fish, fox
Herbivores
Zooplankton, snail, zebra, rabbit
Producers
Green plants, algae, phytoplankton, cyano - bacteria

Fig 12.7 **Pyramid of Energy**

The pyramid of energy is always up right and narrowing sharply from the base to the top level carnivore because there is commonly 90% energy lost at each trophic level. As opposed to pyramid of energy, pyramid of biomass or number can be up right (with the long bar at the base and shorter bar at the top) or inverted depending on the type of ecosystem and the particular food chain.


A
B
Tilapia (fish)
Daphnia (zooplankton)
chlorella (green algae)
Tilapia (fish)
Daphnia (zooplankton)
chlorella (green algae)

Pyramid of number

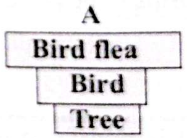
Pyramid of biomass

☑ Pyramid of energy is always up right. How ever, pyramid of number and pyramid of biomass can be up right or inverted and this depends on the given food chain and the particular ecosystem.

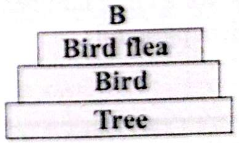
Conceptual Example

1. Construct pyramid of number and pyramid of biomass for the following food chain and explain? Tree → bird → bird flea

Explanation


A
Bird flea
Bird
Tree

Pyramid of number


B
Bird flea
Bird
Tree

Pyramid of Biomass

A single tree will support a very large population of birds which inturn will be eaten by smaller population of bird flea. A more realistic picture is gained by considering pyramid of biomass.

- Pyramid of number and biomass can be up right or inverted. This depends on the given food chain and the particular ecosystem.
- But the pyramid of energy is always up right.

2. What is the trophic level of a human being? Explain

Explanation

Human beings are omnivores; they eat either plans is or other animals that feed on plants. Thus, human beings are herbivores at one time and carnivores at an other type, which correspond to second or third trophic level respectively.

3. Why energy can not be recycled? How ever, nutrients are recycled? Explain

Explanation

The energy from the sun flows through plants and enter in to the ecosystem through photosynthesis But this energy can not be go back to the sun Nutrients are recycled with in an ecosystem and are used again and are used again and again. This is because nutrients are synthesized (composition) and decomposition (break down) in the ecosystem.

4. Why is trophic level usually limited to 3 or 4? Why not more?

Explanation

- Trophic level is usually limited to 3 or 4, because energy is successively decreasing as it is transfered from one level to other level and sufficient energy for life will not reach organisms 4 trophic level.

5. Why is it unusual for a large number of organisms to be present at the top of an ecological pyramid?

Explanation

Because energy successively decline as it is transfered to higher trophic level and can supports only small number of organisms.

6. Which feeding level is found at the base of all food chain? Explain

Explanation

Autotrophs (primary food producers), green plants and algae can produce food by the process of photosynthesis. All living (consumers) things directly or indirectly depends on producers for food. Thus, they are found at the base of all food chain.

12.2 Cycling of Materials in the Ecosystem

Importance of material recycling Why is the recycling of nutrients are importats?

There is limited amount of nutrients in ecosystems. The same atom constantly be re - used again in ecosystems. materials pass from one organism may be input for another organism. All the organisms are an interdependent and interact with their environment.

Processes help recycling of nutrients around the ecosystem when organisms:

- Feed
- Excrete
- Respire and breathe
- Die and decomposed

Nutrients are released when waste products or dead bodies are decomposed.

Decomposers (bacteria and fungi) commonly found in soil. They are returning nutrients to the ecosystem Unlike ingestions of food and digestions by animals in their gut, digestion in decomposers takes place out side the living body in the soil, on the dead organic matter, decomposers exhibits extracellular digestion by releasing enzymes on the dead organic matter. Digesting the complex organic matter in to simpler and smaller ones and absorb these products.

Why is the cycling materials in an ecosystem is so important? This is because:

Nutrients (or materials) such as nitrogen, carbon, oxygen, sulphur, phosphorus are found in a limitted amount in nature. If we are continuously suing them they will be depleted. Hence there must be a means of recycling or regenerating them. Thus, cycling of materials in an ecosystem is so important for sustainable use of resources and existence of organisms.

There fore, life will cease and the ecosystem collapses in the absence of decomposers for materials recycling This happens to organisms if decomposers are absent from the ecosystem.

- Decomposer are found at the end of every trophic level,
- Nutrient elements are in alimilted amounts they have to be decomposed after the death of the organism.

- Nutrient elements that are locked in a living organisms (plants and animals) are released by decomposers after their death and decompositions. They can be used over and over again in the ecosystem. There fore, they have to be recycled.
- Living organisms requires different kinds of chemical elements which are essential for life process. These are carbon, nitrogen, oxygen, hydrogen, phosphorus, water etc.
- The cycle of elements from the environment to organism and back to the environment is called nutrient cycle.
- Nutrients are reused again by all living organisms. Decomposers (bacteria and fungi) play avery significant role in the recycling process.

They break down:

- Dead plant and animals
- The waste of other organisms

Nitrogen Cycle

☑ Nitrogen cycle describes how nitrogen moves between plants, animals, bacteria, the atmosphericair, and the soil.

☑ Nitrogen is vital element for the formation of protein, amino acid, ATP, chromosome (DNA), etc.

☑ But nitrogen can absorbed by plants only in the form of compounds called nitrate.

☑ The atmospheric nitrogen must be converted to ammonia and nitrate by chemical synthesis called decomposers (bacteria)

Proteins are made up of the elements C,H,O and N, most contain S and some contain P. But the immediate results of photosynth is carbohydrate (glucose), which consistes of C,H & O which is transformed to protein up on the addition of nitrogen Nitrogen is available to the plant from the soil through the nitrogen cycle. Nitrogen available for animals are from the food (from plants) in which they are inhabited.

The Major process of Nitrogen Cycle are

- Nitrogen fixation
- Ammonification
- Nitrification

- Assimilation
- Denitrification

1. Nitrogen fixation

- Conversion of free elemental nitrogen in to ammonium ions by nitrogen fixing bacteria.
- But most living organisms are unavailable to incorporate atmospheric nitrogen (free N_2) in to their system.
- There are two types of bacteria are involved in nitrogen fixation (biologically).

i. Free living nitrogen fixing bacteria in the soil

Example Azotobacteria and klebsiella

They convert free N_2 in the soil in to ammonium (NH^+_4) Free $N_2 \rightarrow NH^+_4$

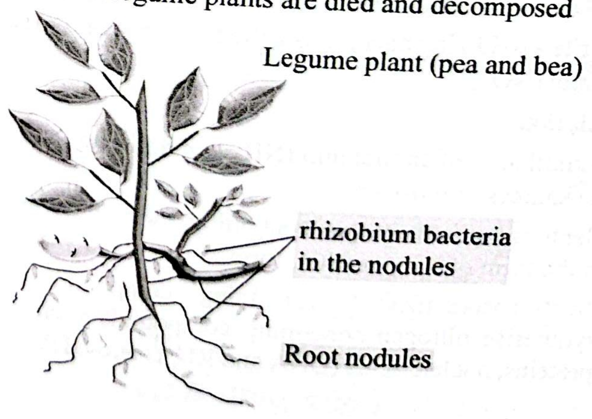
- Ammonium is available in the soil for any plant growing in the area.
- Bulky amounts of ammonium are produced in the soil by this process.

ii. Symbiotic bacteria

The symbiotic bacteria in the root nodules of legumenous plants such as pea, bean, clover, some weeds, pea nuts, etc.

Example Rhizobium bacteria

The ammonium is available to legume plants as well as for other plants in crop rotation or when legume plants are died and decomposed



Rhizobium (Rhizobia - plural) form a symbiotic association with legumenous plants and form the root nodules where free N_2 is reduced in to ammonia.

$$\text{Free } N_2 \xrightarrow[\text{enzyme}]{\text{nitrogenase}} NH_4^+$$

Nitrogen fixation (conversion of N_2) is catalysed by an enzyme known as nitrogenase.

2. Ammonification

- It is called death and decomposition process.
- Both plants and animals died and form detritus.
- Such detritus composed of nitrogen containing organic compounds.
- Detritus and excretory products such as urea, ammonia as well as feaces decomposed in to ammonium ions (NH_4^+). This is done by decomposers (Bacteria and fungi).

3. Nitrification

Ammonius ions (NH^+_4) are oxidized in to nitrates (NO^-_3) in two steps by nitrifying bacteria.

a. $NH_4^+ \xrightarrow{\text{Nitrosomonas}} NO_2^-$ (nitrites)

Nitrosomonas oxidize NH_4^+ into NO_2^- (nitrites)

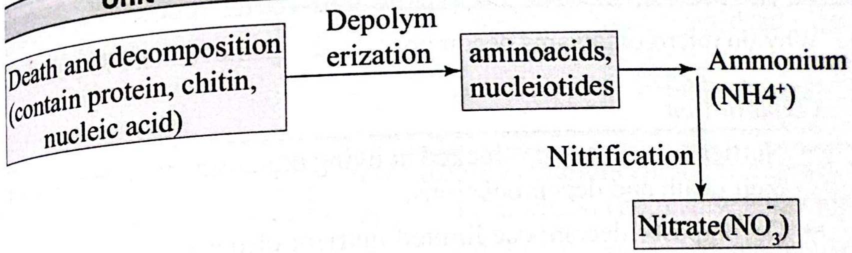
Nitrosomonas is ammonia oxidizing bacteria

b. $NO_2^- \xrightarrow{\text{Nitrobacter}} NO_3^-$ (nitrate)

- Nitrite - oxidizing bacteria is called nitrobacter. oxidize nitrite in to nitrate (NO^-_3)

4. Assimilation

- Assimilation of ammonium (NH^+_4) and nitrate (NO^-_3) by plants for the sources of nitrogen.
- Plants assimilate nitrogen containing inorganic compounds either in the form of NH_4^+ or NO^-_3 form.
- Plants absorb these N_2 containing compounds from the soil to synthesise nitrogen containing compounds such as amino acids, proteins, nucleic acids (DNA and RNA) and ATP.


Death and decomposition (contain protein, chitin, nucleic acid)
Depolym erization
aminoacids, nucleiotides
Ammonium (NH4⁺)
Nitrification
Nitrate(NO₃⁻)

5. Denitrification

- It is the reduction of nitrates in the soil in to free N_2 by pseudomonas denitrifying bacteria. Example pseudomonas.

$$NO_3^- \text{ (nitrate)} \xrightarrow[\text{bacteria}]{\text{pseudimnas}} \text{free } N_2$$

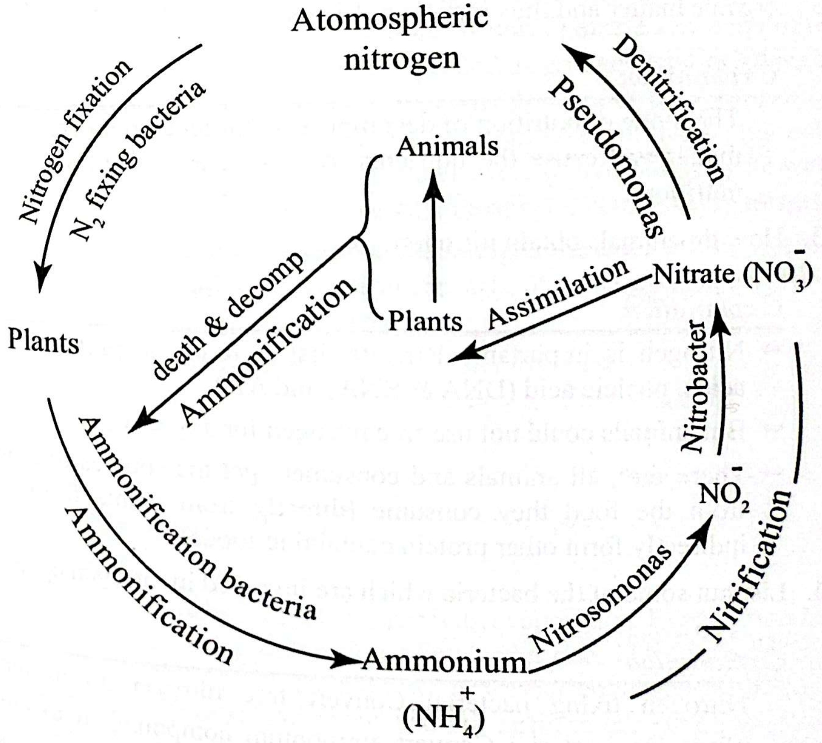

Atomospheric nitrogen
Nitrogen fixation
N₂ fixing bacteria
Denitrification
Pseudomonas
Animals
Plants
Plants
Assimilation
Nitrate (NO₃⁻)
death & decomp
Ammonification
Nitrobacter
NO₂⁻
Ammonification bacteria
Ammonification
Nitrosomonas
Nitrification
Ammonium (NH₄⁺)

Fig 12.8 Nitrogen Cycle

Conceptual Example

1. Why do micro organisms decompose dead organic matter? Explain

Explanation

- Nutrient element that is locked in living organisms are released after their death and decompositions.
- Decomposer decompose limited nutrient elements to be used over and over again in the ecosystem. There fore, materials (nutrients) are recycled.
- But actually they decompose dead organic matter for their interest, to drive energy out of it for their own use.

2. What is the nutritional mode of those bacteria which decompose dead organic matter and thus recycle nutrients?

Explanation

The mode of nutrition of decomposers that feed up on dead organic matter and cause the nutrients to recycle are called saprobiontic nutrition.

3. How do animals obtain nitrogen?

Explanation

- Nitrogen is important elements that is found in proteins, amino acids, nucleic acid (DNA & RNA) and ATP.
- But animals could not use free nitrogen for any sources.
- There fore, all animals and consumers get the sources of nitrogen from the food they consume (directly from plants from plants indirectly form other protein containing foods).

4. List out some of the bacteria which are involved in nitrogen cycle.

Explanation

Nitrogen fixing bacteria: Convert free nitrogen in to nitrate.
Nitrifying bacteria: Convert ammonium compound in to nitrate.
Ammonifying bacteria: Convert dead bodies in to ammonium compound.

Denitritying bacteria: Convert nitrates in to free atmospheric nitrogen.

5. Which process in nitrogen cycle release ammonia from dead organic matter?

Explanation

The process in nitrogen cycle called ammonification decomposes the dead organic matter (dead plants and animals) and release ammonia.

- The decomposers (bacteria and fungi) are called ammonifying bacteria and the process that releases ammonia from dead organisms called ammonification.

Water Cycle

In water cycle rain that falls at a place can be the result of evaporation from water bodies (ocean or sea) and transpiration. The earth has a limited amount of water on earth 97.5% of water is non - potable salt water of the remaining water 99% is locked under ground as ground water or asice cap in the polar areas. Thus, less than 1% of fresh water is easily accessible from lake and rivers This easily accessible from lake and rivers This water keeps going around what we called water cycle or hydrologic cycle water continuously cycle between the ocean, atmosphere, land, and organisms.

A change in temperature, heating and cooling is the main driving force in the water cycle, causing a change in the state of water as a water vapour, ice or snow (solid), and liquid water.

The most important processes in to the water cycle are:-

- Evaporation
- Transpiration
- Condensation
- Precipitation
- Run off

The solar heating help the cycle to start with evaporation. Evaporation from water bodies and transpiration from plant leaves rises in the atmosphere in the form of water vapour. Then the water vapour cools and condenses in the atmosphere in to rain or snow, and fall again to the earth's surface as precipitation (rain fall or snow fall the surface water from ocean) sea and river by evaporation and evapotranspiration will restart the cycle again.

Water can change it's state from solid (Ice) to liquid (water) and then to

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vapor (water) and then to vapor (gas).

$$\text{Ice (solid)} \xrightleftharpoons[\text{Freezing}]{\text{Melting}} \text{Water (liquid)} \xrightleftharpoons[\text{Condensation}]{\text{Evaporation}} \text{Vapour (gase)}$$

The Processes in Water Cycle are

Evaporation: The solar heating helps the water cycle to start with evaportation.

- It is the sending out of water to the atmosphere.
- Heat converts liquid water in to vapour.

Condensation: The evaporated water cools down and turns in to cloud (water droplets).

- When the rising water vapour meeting cold air in the atmosphere, it is turning back in to water dropletes called condensation.

Transpiration: The release of water from plants mainly through the stomata of the leaf.

Precipitation:- The coming back of condensed water dropletes in the form of rain, snow, etc.

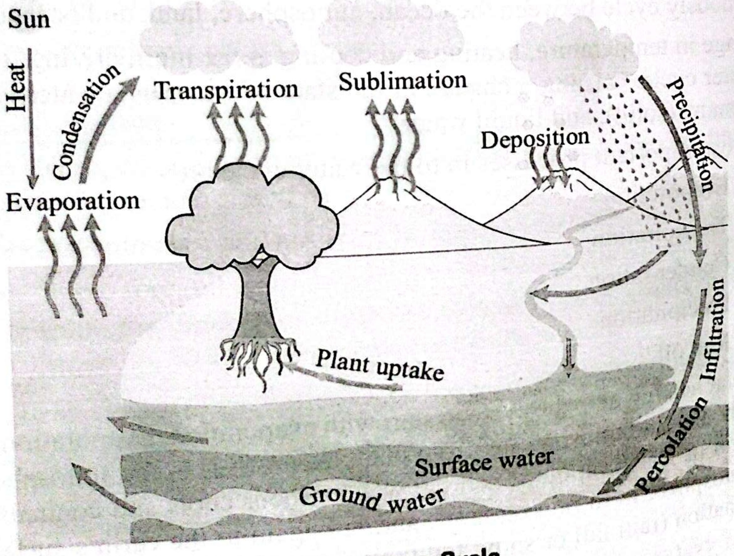

Fig 12.9 Water Cycle

Oxygen Cycle

☑ The main driving factors of oxygen cycle are the process of photosynthesis.

☑ Photosysthetic organisms are green plants, algae and cyano bacteria (blue green algae).

☑ They make oxygen by the process of photosynthesis. oxygen released as a by product to the atmosphere during the process of photosynthsis.

☑ Oxygen taken from the atmosphere for respiration. living organisms respire.

☑ Oxygen also support burning and also used for respiration.

Carbon Cycle

☑ All living organisms have carbon as the basis for life.

☑ The basic processes in the carbon cycle are photosysthesis and respiration.

☑ Organisms need carbon - containing compounds as a sources of energy and the raw materials for body building.

Example: proteins, carbohydrates, fats, etc.

☑ Autotrphs (producers) obtain carbon in the form of CO_2 from the atmospheric air to make these organic compounds during photosynthesis Thus, photosynthesis process is the only process that reduce (remove) carbon in the form of CO_2 from the atmosphere. Green plants, algae, cyanobacteria (blue green algae) can photosynthesise.

☑ The break down of these organic compounds (carbon - containing compounds) to release energy in respiration processes release carbon dioxide to the atmosphere.

The Main Process Involved in Carbon Cycle are

1. **Photosynthesis:** fix carbondixied (in organic) in to organic compounds (glucose) by the process of photosynthsis.
2. **Feeding and assimilation:-** passing carbon atom by eating using food chain. Example from producers to consumers.
3. **Respiration:** release of carbon dioxide by oxidizing organic compounds (carbon containing compounds).
4. **Fossilization:** formation of fossils from dead organic matter.

- Some times living things do not decay fully when they die due to the condition in the soil, and fossil fuels (coal, petrolium and natural gases) are formed.

5. **Combusion:** is burning of fossil fuel, releasing carbon dioxide in the atmosphere.

Cycling carbon is essental to the living world as all organic molecules found in living organisms are formed basically from carbon.

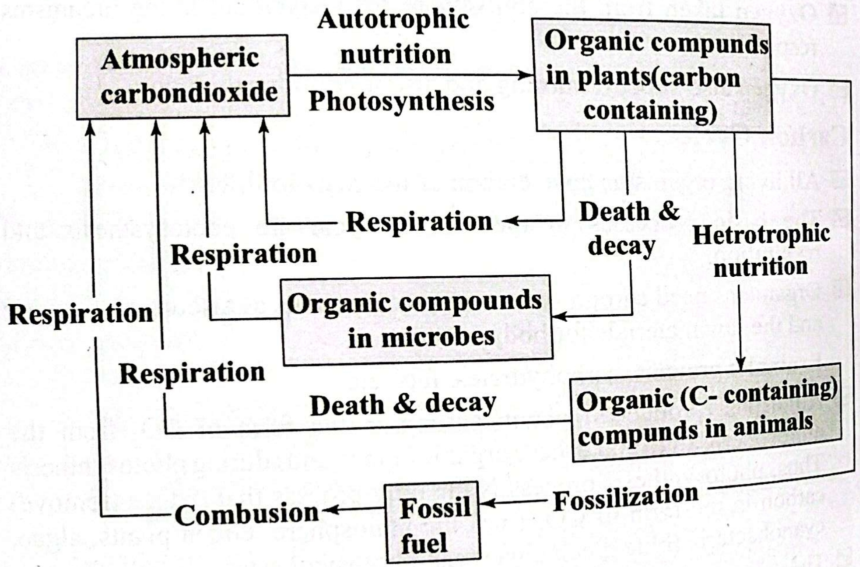
Autotrophic nutrition
Atmospheric carbondioxide
Photosynthesis
Organic compunds in plants(carbon containing)
Respiration
Death & decay
Hetrotrophic nutrition
Respiration
Respiration
Organic compounds in microbes
Respiration
Death & decay
Organic (C- containing) compunds in animals
Combusion
Fossil fuel
Fossilization

Fig 12 .10 The Carbon Cycle

Carbon dioxide is anatural part of the earth's atmosphere. Human produce more of it every year, and that's changing our climate. Atmospheric concentration of CO_2 increased since the industrial revolution (18th century) Burning of the fossil fuel (coal, natural gas, and petrolium oil) and fire wood are the major sources.

Carbon dioxide acts like a heat - trapping blanket, absorbing the heat and holding it in, causing global warming.

Global warming is the rise of the overall temperature of the earth's surface. Thus, CO_2 is called green house gase other green house gases are methane and nitrous oxide, but CO_2 is the major one. Thus, addition of excessive CO_2 in to the atmosphere by human activities are the root causes of climate change (global war mining)

Conceptual Example

6. Mention the two most important life process involved in carbon cycle?

Explanation

The two most important life processes which are involved in carbon cycle are photosynthesis and respiration.

7. Mention the processes that increase carbon concentration in the atmosphere in the form of carbon dioxide?

Explanation

The carbon dioxide gase is released in to the atmosphere during:

- Burning of fossil fuel from industries or cars.
- Burning of the forest
- Industries production
- Respiration from animals and plants
- Decomposition and decay as microbes respire.

8. Explain how organic molecules are passed from plant and animals to decomposers?

Explanation

It is when plant animals died and decomposed by decomposers. Decomposers feed on dead organic matter by saprobiotic mode of feeding on the dead remains of organisms organic molecules are passed.

9. Explain global warming? Which one is mainly responsible for warming of the globe?

Explanation

Global warming is the rise of the over all temperature of the earth's surface. But due to the human impacts on the ecosystem (environment) carbon dioxide emission is increased. Carbon dioxide acts like a heat - traping blanket, which absorb the heat and holding it in. This gase, carbon dioxide, is called green house gas. There fore, carbon dioxide is responsible for global warming.

10. Explain how the human activities are the main contributor for global wariming?

Explanation

Human being burn fossil fuel in industries, cars, in house hold activities, etc. This combustion of fossil fuel increase the carbon dioxide concentration in the atmosphere. Addition of excessive carbon dioxide in to the atmosphere by human activities are the root causes of climate change (global warming).

11. Explain the process that removes (or decreases) carbon concentration from the atmosphere?

Explanation

The concentration of carbon in the form of carbon dioxide in the atmosphere is responsible for global warming. It increases mainly by Foss is fuel combustion. The only process whose responsibility lies to remove (or decrease) the carbon in the form of carbon dioxide from the atmosphere is the photosynthetic process which is carried out by green plants and algae.

12.2.1 Phosphorus Cycle

How is phosphorus recycled?

☑ The core phosphorus cycle is much the same as core nitrogen cycle.

☑ Phosphorus is present in organisms in the form of phosphater (PO^{3-}_4).

☑ Phosphate (PO^{3-}_4) is absorbed from the soil (or water) by plants.

☑ Organic phosphate synthesized by the producers (plants) are passed along the food chains to various herbivores and carnivores.

☑ On death and decomposition, their bodies release phosphate Ions $(PO^{3-}_4$ ions) from compounds like phosphlipids, ATP, DNA and RNA (which are phosphate containing compounds) and are returned to the soil or water.

☑ Phosphates also enter the soil (or water) as aresult of :
- Weathering of rocks
- In the form of fertilizers.

☑ Phosphate fertilizer from farm lands can be leached by rain fall, and

reach to aquatic plants and causes eutrophication.

☑ **Eutrophication:-** is undesirable excessive growth of aquatic plants (hydrophytes) and massive growth of algae (algal bloom) is called eutrophication.

Conceptual Example

12. Explain the role of phosphorus in living organisms?

Explanation

Phosphorus is an important constituent parts of plasma membrane (phospolipid), ATP, DNA,RNA amino acids and proteins.

13. Explain how phosphorus is passed from soil to plants?

Explanation

Plants absorb phosphorus containing compounds from soil in the form of (PO^{3-}_4)phosphate. The root of plants absorb phosphate.

14. Mention how human and animals get a sources of phosphorus?

Explanation

Human and animals get a sources of organic phosphorus from the food they consume. Plants absorb phosphorus from the soil and animals that eat the plants reuse the organic phosphorus.

15. Explain the phosphorus cycle?

Explanation

Plants absorb phosphorus containing compounds in the from of phosphate. phosphate absorbed by the roots of plants from the soil.
- Organic phosphate is synthesized by producers (plants) are passed along the food chain.
- When consumers (herbivores, carnivores & omnivores) died, phosphorus is returned to the soil.
- Plants are also get a sources of phosphates as in the form of phosphate from:
  - Dead organic matter.
  - Phosphorus containing fertilization.

➥ Weathering of rocks.

16. Why is it unusual for alarge number of organisms to be present at the top an ecological pyramid?

Explanation

Because energy successively declines as it is transferred to higher trophic level and supports small number of organisms.

17. How do plants get nitrogen.

Explanation

Plants can not use atmospheric nitrogen directly, it should be transformed to ammonium and nitrate (NO-3) by nitrogen fixing bacteria and nitrifying bacteria.

18. List down the advantage of organic fertilizer as compared to chemical fertilizer.

Explanation

➥ The organic fertilized such as compost and bioslurry slowly releases nutrients to be taken by plants as compared to in organic (or chemical fertilizers).

➥ They can not be easily leached (washed a way).

➥ They improve soil physical - chemical properties such as soil moisture & PH.

19. What is the difference between cutting tress and forest burning interms of

a. Carbon dioxide concentration in the atmosphere

b. Effects on global warming

Explanation

Forest clearing (cutting trees) is removing plants that could have taken CO_2 from the atmosphere for photosynthesis. This indirect helps accumulation of carbon, there by increasing chance of global warming.

➥ Forest burning directly increases carbon dioxide to the atmosphere, there by increasing global warming.

Part III Multiple Choice Items

Choose the best answer from the given alternatives

12. Which one of the following cycle contain both photosynthesis and respiration:

A. Carbon cycle
B. Oxygen cycle
C. Water cycle
D. Nitrogen cycle

13. The main driving factor on oxygen cycle is _____

A. Heterotrophs
B. Chemosynthesis
C. Photosynthesis
D. Decomposers

14. The convertion of carbon from air to food and back to air is called ___

A. Oxygen cycle
B. Carbon cycle
C. Nitrogen cycle
D. None

15. One of the following is not cycled in nature:

A. Oxygen B. Carbon C. Energy D. Nitrogen

16. The organisms that play greatest role in all nutrients are.

A. Producer
B. Consumers
C. Decomposers
D. Herbivores

17. Which one of the following biomass is used as energy gain for the organisms?

A. Biomass lost in feaces and urine
B. Biomass ingested as food
C. Biomass used to provide energy for movement
D. None

18. Organisms in a food chain get its energy by eating other organisms (plants or animals) is called ___

A. Producers B. Consumers C. Decomposers D. Host

19. Which one is the primary producers in aquatic food chain called ____

A. Zoo plankton
B. Sardin
C. Phytoplankton
D. Shark

20. All animals get a sources of nitrogen from _____

A. Plants they consume
B. Breathe in from the air
C. Decomposers
D. None

21. Amounts of carbon increases in the atmosphere due to:-

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A. Photosynthesis
B. Burning of fossil fuel
C. Decomposers
D. Producers

Part IV Matching Item # 4

	A	B
22.	Transpiration	A. Plants absorb from the soil as anitrogen sources
23.	Fossil fuel	B. Play the main role in recycling of nutrients
24.	Nitrate	C. A process of converting nitrates in to nitrogen and it become parts of the atmospheric air.
25.	Decomposers	D. The sending out of water from plants.
26.	Denitrification	E. It's combussion increases the amounts of carbon dioxide in the air.

End of unit Review Questions

Part I Multiple choice Items choose the best answer among the given choices

1. A complex food relation ship that contain multidirectional food relation between organisms is :-
A. Food web
B. Food chain
C. Producer
D. Consumer

2. The pair of processes which return CO2 to the atmosphere are:
A. Respiration and composion
B. Photosynthesis
C. Evaporation and respiration
D. Photosynthesis and decomposition

3. What functions do soil bacteria serve in the nitrogen cycle?
A. Store nitrogen nodules underground
B. Attach nitrogen to soil particles from the ground to the air water soluble form.
C. Release nitrogen
D. Convert nitrogen to usable form for plants

4. Ammonium compounds are oxidised to nitrate by ______
A. Nitrogen fixing bacteria
B. Nitrifying bacteria
C. Denitrifying bacteria
D. Putrefying bacteria

5. Which of the following gases results in global warming when accumulated in the atmosphere?
A. Hydrogen
B. Carbon dioxide
C. Oxygen
D. Nitrogen

6. Microscopic photosynthetic organisms at the beginning of aquatic food chain are:
A. Zooplankton
B. Phytoplankton
C. Animal plankton
D. None

7. Which group of organism has the highest efficiency of obtaining energy from grasses?
A. Primary consumer
B. Tertiary consumer
C. Secondary consumer
D. First trophic level

8. Which one of the following can not be recycled in an ecosystem?
A. Carbon B. Water C. Energy D. Phophorus

9. Which one of the following process does not contribute to the loss of biomass in an ecosystem?
A. Excretion
B. Photosynthesis
C. Respiration
D. Egestion

10. What is the general name of crop plants that added nitrogen to the soil:-
A. Nodules B. Legumes C. Rhizobium D. Cereals

11. The micro organisms that break - down dead - matter are
A. Herbivores
B. Detritivores
C. Decomposers
D. Nitrogen - fixing bacteria

12. In the nitrogen cycle, nitrogen gas is returned to the atmosphere by:
A. Nitrogen fixing
B. Nitrifying bacteria
C. Denitrifying bacteria
D. Ammonifying bacteria

13. Carbon dioxide is removed from the atmosphere when:
A. Animals respire
B. Plants respire
C. Plants photosynthesis
D. Plants and animals respire

14. Which of the following statement about nitrogen cycle is true:-
A. Plants fix nitrates in to atmospheric nitrogen.
B. All the nitrogen obtained by animals came from plants.
C. N_2 is consumed by bacteria and removed from the soil.

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D. N_2 fixing bacteria reduce the total amount of available N_2 cycle.

15. One of the following is not involved in the water cycle.

A. Transpiration
C. Assimilation
B. Evaporation
D. Condensation

16. In the food chain

Grass → rat → snake → Eagle

The position of snake is at ______ consumer level and ______ trophic level.

A. 3,2
B. 3,4
C. 4,3
D. 2,3

17. The biomass of an ecosystem is

A. The total energy of living and non - living organism in an ecosystem.
B. The total mass of living organisms in an ecosystem
C. The total energy of living organisms in an ecosystem.
D. The total mass of living and non-living matter in an ecosystem.

18. In nitrogen fixation, nitrogen combine with

A. Carbon
B. Hydrogen
C. Oxygen
D. Water

19. What is the correct term for rising water vapour meeting cold air and turning back in to water droplets?

A. Condensation
C. Dehydration
B. Evaporation
D. Precipitation

Part II. True - False Items say True for the correct statement and False for incorrect statement

20. There is more energy at the third tropic level than at the second trophic level.

21. Ammonia is more preferred by plants that nitrate.

22. Plants can release as well as take carbon to and from the atmosphere.

23. Denitrifying bacteria releases free nitrogen to the atmosphere.

24. It is food web, not food chain that actually exists in the ecosystem.

Part III. Matching Items Match the terms under column B with description under column A

A

25. Is the process by which the protein in the waste matter, dead plants & animals converted to ammonia
26. CO_2 is the waster products of this biological process
27. The position of an organism in an order of recieving solar energy
28. This process converts atmospheric nitrogen in to usable form
29. The position of an organism in an order of who eats whom
30. This contributes to the turn of vapour to the atmosphere

B

A. Ammonification
B. Condensation
C. Denitrification
D. Evaporation
E. Feeding level
F. Nitrogen fixation
G. Photosynthesis
H. Respiration
I. Trophic level

Part IV Fill in the Blanks Spaces

31. ______ is the complex feeding inter relation ship between organisms
32. Organisms that breakdown the dead bodies of other organisms are called ______
33. The form of nitrogen that can be directly used by plants is called ____
34. Level in a food chain an organism belong is called _____
35. ___ is the sum of all the organic material produced by living organisms.

Answer Key

Supplementary Exercises

Part III Multiple choice Item

12. A
13. C
14. B
15. C
16. C
17. B
18. B
19. C
20. A
21. B

Part IV Matching Items

22. D
23. E
24. A
25. B
26.C

Answer Keys

For End of Unit Review Questions

Part I Multiple Choice Item

1. A
2. A
3. D
4. B
5. B
6. B
7. A
8. C
9. B
10.B
11.C
12.C
13.C
14.B
15.C
16.D
17.B
18.B
19.A

Part II True - False Items

20.False
21.True
22.True
23.True
24.True

Part III. Matching Item

25.A
26.H
27.I
28.F
29.E
30.D

Part IV Fill in the blank spaces

31.Food Web
32.Decomposers
33.Nitrate
34.Trophic level
35.Biomass

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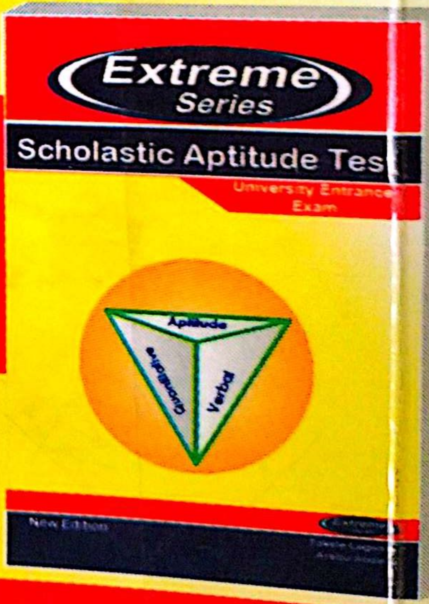
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